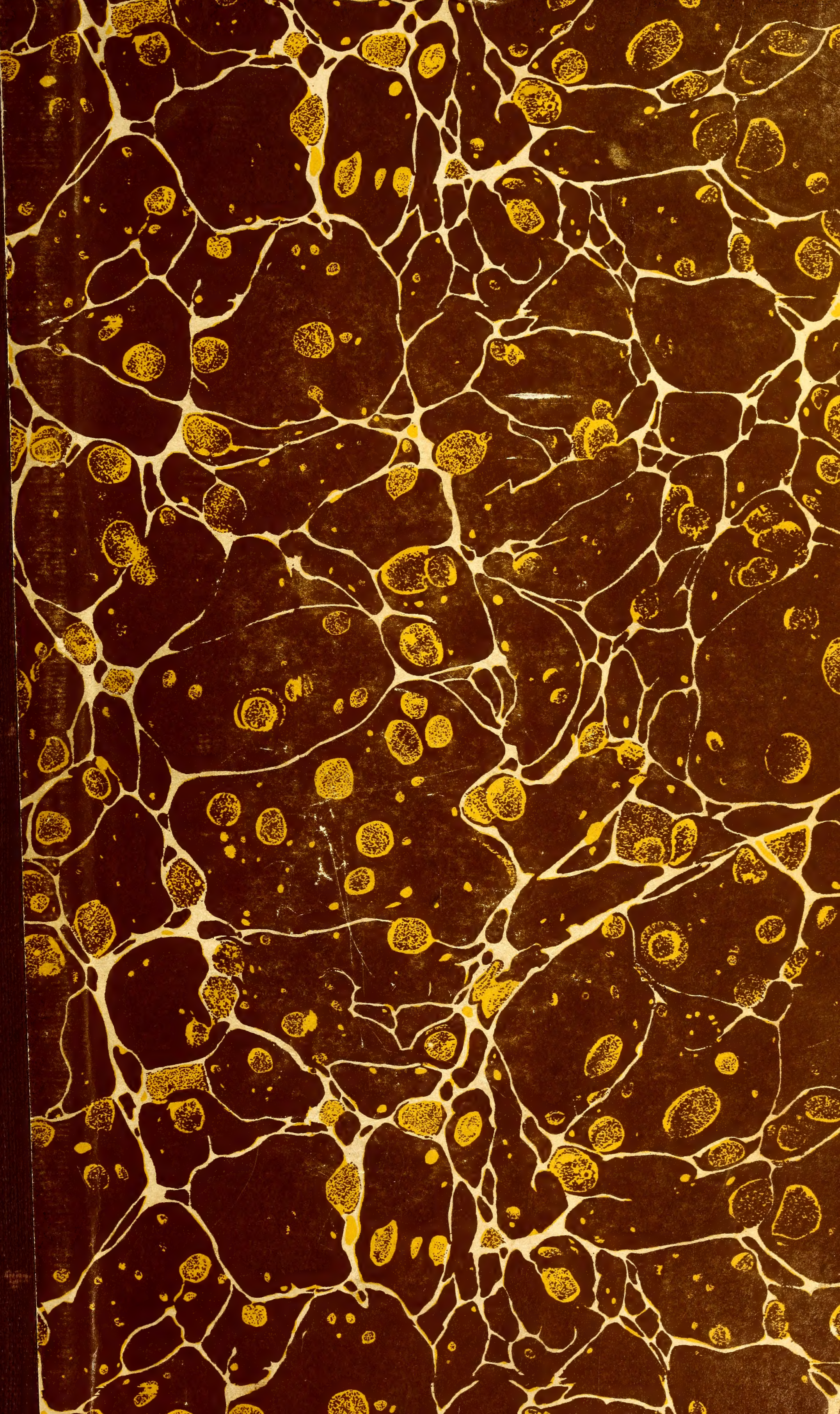

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ERRATA

VOL. XLI, No. 4

Page 699, line 16, from bottom, *for* 'Tan-Kwe' *read* 'Taw-Kwe'.

,, 801, below the Plate facing p. 801, *for* 'approx. x 1½ *read* 'approx. x 3'.

,, 801, line 17, from top *for* 'Cocoyx' *read* 'Coccyx'.

,, 804, last line *for* 'approx. x 1½' *read* 'approx. x 3'.

,, 819, line 4, from bottom, *for* 'eugenla' *read* 'eugenia'.

,, 881, ,, 12, from bottom, (Area of controlled forest in square miles in Indore) *for* '260' *read* '2600'.

,, 881, line 5, from bottom (Area of controlled forest in square miles in Hyderabad State) *for* '546' *read* '9485·35'.

VOL. XLII, No. 1

Page 116, line 6, from top, *for* 'S. sp. Nov.' *read* 'Sp. Nov.'.

,, ,, ,, 16, from bottom, *for* 'S. sp. Nov.' *read* 'Sp. Nov.'

,, 123, lines 14 and 16, from bottom, *for* 'Tujuria' *read* 'Tajuria'.

,, 207 (Misc. Note No. XXI) right through this note *for* 'Triperestrata' *read* 'Trifenestrata'.

,, 209 (Misc. Note No. XXIII) line 22, from top *for* 'nibbed' *read* 'nibbled'.

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Allahabad Agricultural Institute	Allahabad.
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Deo, Raja Sri Balavadra Narayan Bhunj	Keonjhargarh.
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Dewas Junior, H. H. the Maharaja Saheb of	Dewas Jr.
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Dickson, Lt.-Col. H. R. P. (C.I.E.)	Persia.
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Etaiyapuram, The Rajah of	Etaiyapuram.
Evans, Col. G. H. (C.I.E., F.L.S.)	London.
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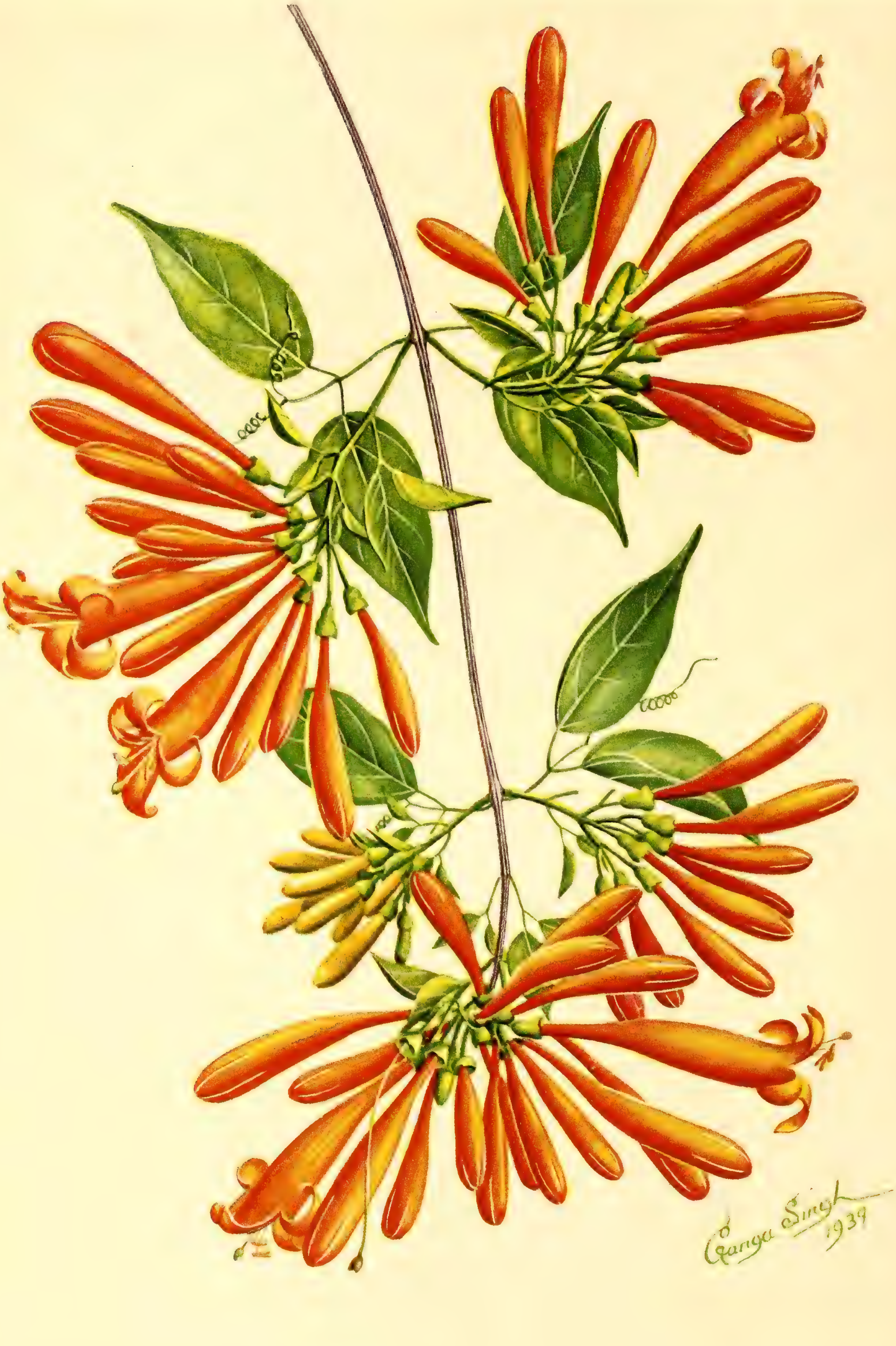
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Bignonia venusta, Ker.
(5/8 nat. size)

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SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

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PART III.

(*Continued from Vol.* xli, *No.* 2 (1939), *p.* 220).

(*With one coloured and* 3 *black and white plates and* 5 *text-figures*).

Bignonia Linn.

The genus *Bignonia* was erected in honour of Abbé Jean Paul Bignon (1662-1743), court librarian to Louis XIV of France. Systematic botanists in the past have held very divergent views regarding the delimitation of this genus and modern research has resulted in the genus, as conceived by Bentham and Hooker with its 150 species, being broken up and the majority of its species transferred to other genera. We would warn our readers that the species, hitherto known as *Bignonia,* found in our Indian gardens and treated in this article, have all, with the exception of one, been placed in other genera of the Bignoniaceae.

The species of the genus, as known to horticulturists, have been in high favour for many years on account of the beauty and profusion of their flowers. They are mainly extensive climbers and require generous space to be seen at their best.

The wood of the stem is very peculiar. Young stems do not show any anomalous structure, but in old stems the wood is cleft by wedge-shaped radially projecting masses of bast, which are regularly arranged in multiples of four. Those with four wedges are called 'Cross Vines' in South America and are regarded with superstitious awe. Some of these climbers grow to an immense size, and these alternating wedges of bast and wood enable them to withstand twisting and bending without fracture.

Climbing is accomplished in various ways—by twining round a support, by the possession of tendrils, by the rotation of the petioles, or by means of aerial roots. The species treated in this article make use of all these methods, either singly or in various combinations. The possession of tendrils is a very common feature.

Tendrils are always modified leaves or leaflets. In the well-known *Bignonia venusta* Ker. [*Pyrostegia venusta* (Ker-Gawl.) Miers], the foliage seems at first sight to consist of a pair of opposite leaves upon a common peduncle the apex of which is continued and ends in three filiform branches. The correct interpretation of this arrangement is that the leaf is compound and consists of three leaflets, the terminal of which is modified as a branched tendril. The tendril after attachment to a support contracts spirally, and not only raises the stem but also permits a certain elasticity in the attachment of the liane to its support and thereby minimises the danger of damage from storms. The tips of the tendrils after attachment often become transformed into small disks.

The leaves of the species may be simple or compound and are exstipulate, though the development of small leaves in the axils of true leaves often simulate foliaceous stipules.

The flowers are arranged in terminal or axillary pairs or racemes or in corymbose fascicles. The calyx is of combined sepals with obscure lobes or teeth. The corolla is large and showy, zygomorphic and usually bell- or trumpet-shaped, less often cylindrical, rarely 2-lipped, 5-lobed. The stamens are five in number but the posterior one is usually rudimentary and represented by a small stipe. The other four are paired, two with long filaments, and two with short; a condition which is termed didynamous. The anther cells are usually divergent at the base.

The ovary is seated upon a disk which may be cupular or platter-shaped, and is two-celled. The ovules are numerous and are attached to axile placentas. The style is simple with two flattened stigmatic lobes. The fruit is usually a two-valved capsule.

In species of this genus whose life history has been studied it is found that the stigmas and pollen become mature at different times and that the stigma-lobes close before the pollen from the same flower can fertilise them. Cross fertilisation seems to be the rule in the genus and in the case of those species imported into India from abroad the agent of pollination seems to be absent in this country, for very few of our exotic species set fruit.

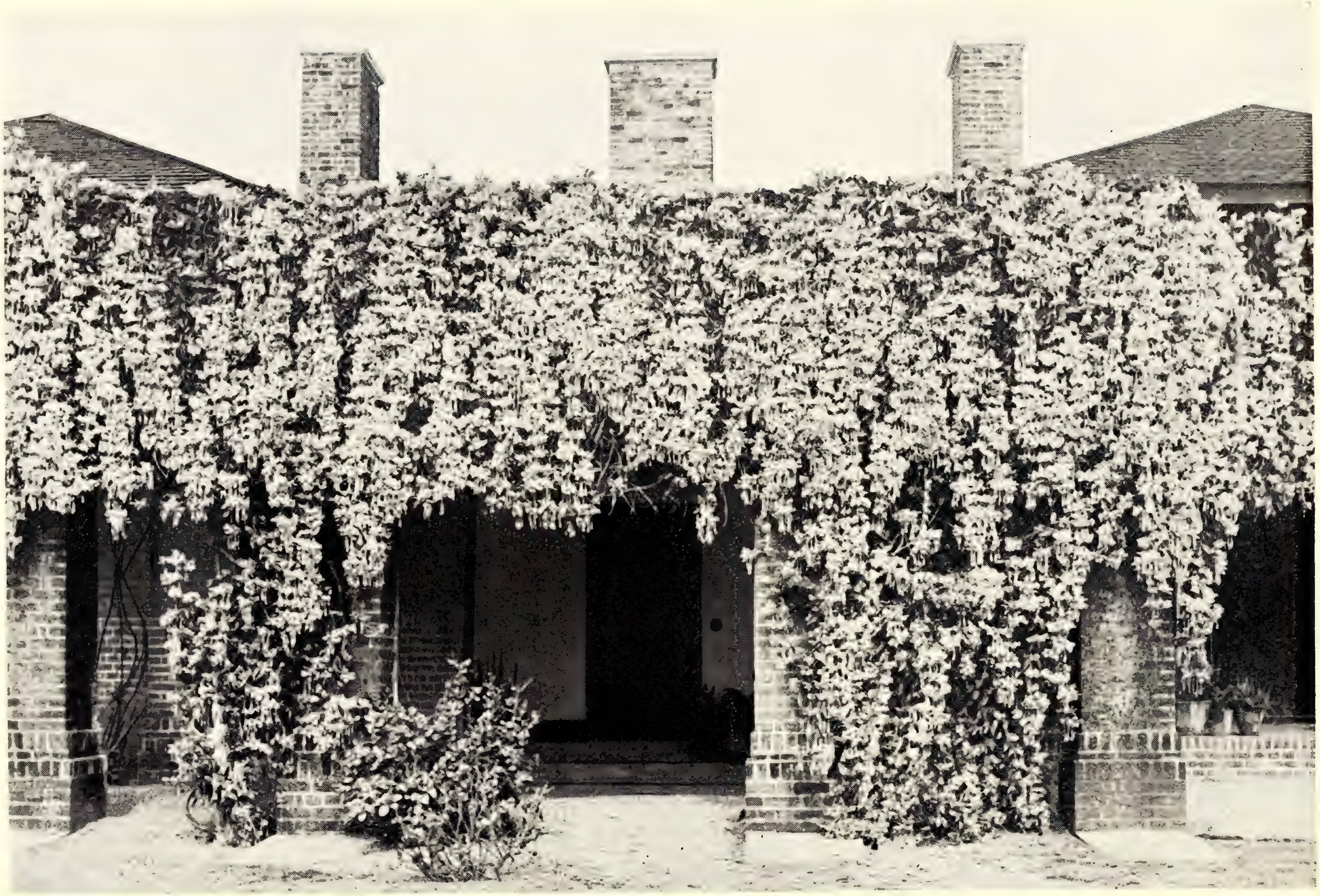

Photo by M. N. Bakshi.

The Golden Shower (*Bignonia venusta* Ker.)

New Forest, Dehra Dun.

KEY TO THE SPECIES.

Tendrils 3-partite.
- Corolla cylindrical ... ... *B. venusta.*
- Corolla swollen upwards.
  - Tendrils clinging by disks ... ... *B. capreolata.*
  - Tendrils clinging by claws or hooks ... ... *B. unguis-cati.*

Tendrils simple.
- Disk present; flowers rose with darker stripes; leaves shining ... ... *B. speciosa.*
- Disk absent; flowers pale mauve, purplish with a white or yellowish throat; leaves dull ... ... *B. magnifica.*

Bignonia venusta Ker. [**Pyrostegia venusta** (Ker-Gawl.) Miers]. Golden Shower.

(*venusta* is Latin for 'charming', 'beautiful').

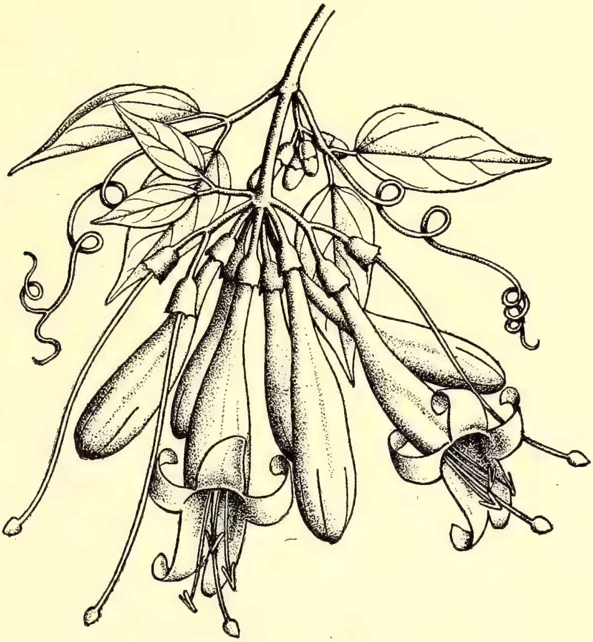

Fig. 1.—*Bignonia venusta* Ker.

Description.—An evergreen plant climbing extensively by means of tendrils. Stems stout, angled. Leaves compound, consisting of two leaflets with a terminal branched tendril, or sometimes of three leaflets. Leaflets ovate or ovate-oblong, bluntly and shortly acuminate, wedge-shaped at the base, 2—4 in. long, glabrous on the upper surface, shortly and sparsely hairy beneath.

Flowers very showy, arranged in corymbose cymes or racemes, drooping. Calyx small, campanulate in shape, with five, very small, hairy teeth. Corolla tubular, 3 in. long, gradually expanding to the mouth where it ends in five linear lobes which are valvate in the bud (i.e., they touch by their margins), the point of junction being very evident as each lobe has white villous margins. On opening the lobes curve backwards and form two lips, the upper of which is 2-, the lower 3-lobed. Stamens four, in pairs, with filaments of different lengths. The longer pair is well exserted from the tube, the shorter reaches the base of the lobes. Ovary linear, seated on a fleshy disk. Style very long, almost as long as the stamens. This plant does not produce fruit in this country.

Flowers.—Cold season.

Distribution.—Indigenous to Brazil, but now a very common cultivated plant in all tropical countries.

Gardening.—Probably no plant in the world presents so gorgeous an appearance as *Bignonia venusta* when in full bloom during Jan.—Feb. The plants are not fastidious as to soil but a good fibrous loam, to which one-third cow or sheep manure has been added, suits them admirably. Propagation is effected by cuttings of the wood taken in late spring and inserted in sand preferably under a bell jar. It is suitable for pergolas in the open, porches, verandahs and the like.

Bignonia capreolata Linn. [**Doxantha capreolata** (Linn.) Miers].

Trumpet Flower. Cross Vine. Quarter Vine.

(*capreolata* is a Latin word meaning 'winding' or 'twining').

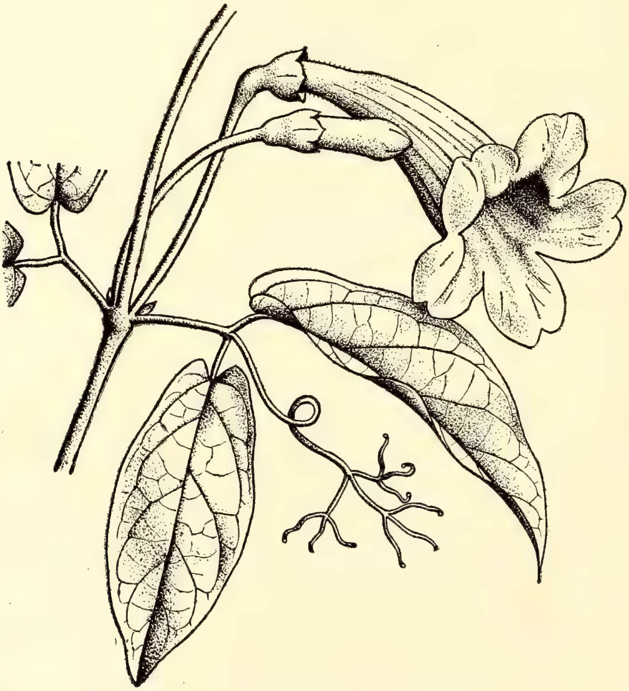

Fig. 2.—*Bignonia capreolata* Linn.

Description.—An extensively climbing, glabrous species. The older stems in section exhibit a perfect cross of four wedge-shaped insertions of bast in the wood. The leaves are opposite and compound, consisting of an ovate or oblong, acuminate and subcordate pair of stalked entire leaflets and a compound tendril which clings by small disks. Stipules are absent but accessory leaves or leaflets in some of the axils simulate foliaceous stipules.

The flowers are borne on pedicels which are arranged in fascicles of 2-5 on axillary spurs. The calyx is membranous, green, ·2 in. long. The corolla is tubular with a stout limb, 2 in. long, yellowish red in colour, rather lighter within.

Flowers.—March—April. Does not set fruit in Dehra Dun.

Distribution.—This climber is indigenous in North America, but is now extensively grown as an ornamental plant in the tropics of the Old World.

Gardening.—This handsome vine is very suitable for covering walls, embankments and the like. Propagated by cuttings or layers of half matured wood.

Bignonia unguis-cati Linn.

Cat's Claw (in Latin *unguis cati*).

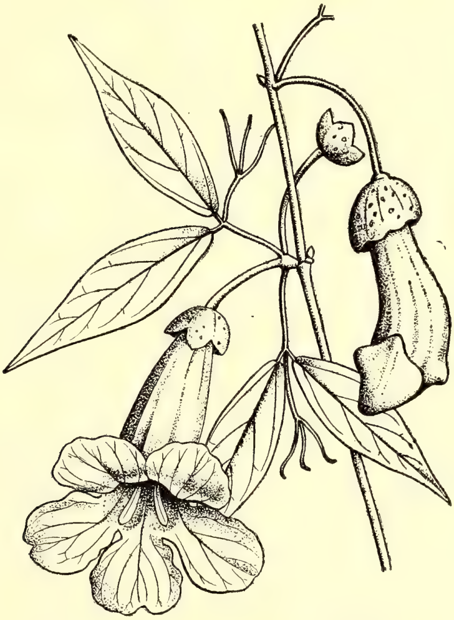

Fig. 3.—*Bignonia unguis-cati* Linn.

Description.—An extensively climbing, slender, evergreen species. The leaves are opposite and compound, exstipulate. Leaflets 2, lanceolate or ovate-acuminate, cordate, 3 in. or less long; the terminal leaflet is represented by a three-partite claw-like tendril, the arms of which do not form disks after attachment. The flowers, which are a beautiful clear yellow in colour, with deeper yellow lines in the throat, are borne in pairs seated on slender peduncles in the axils of the leaves. Calyx ·5 in. long, obtusely 5-lobed, membranous, bowl-shaped, with conspicuous veins. Corolla with a short tube and broadly ventricose limb with spreading lobes, 2-4 in. across and 2-2·5 in. long. Ovary linear, ·25 in. long, seated on a fleshy disk. Style curved, 1 in. long.

Flowers.—April. Occasionally a second flush in Aug. *Fruits.* July.

Distribution.—This climber is a frequently cultivated plant in India. It is a native of Argentina.

Gardening.—An extensive climber reaching the tops of the tallest trees and forming masses of foliage and yellow flowers in pendent bunches. It sows itself freely in Dehra and also probably elsewhere. Easily raised from seed or by layers or cuttings.

Bignonia speciosa R. Grah. [**Clytostoma callistegioides** (Cham.) Baill.].

(*speciosa* is Latin for 'handsome').

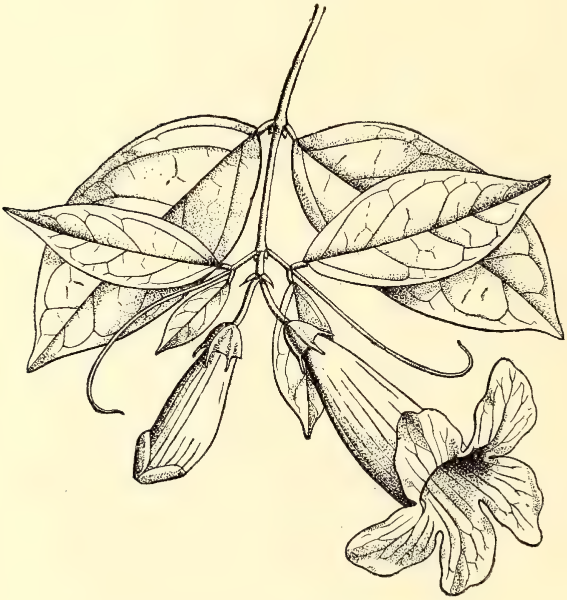

Fig. 4.—*Bignonia speciosa* R. Grah.

Description.—An evergreen shrub, extensively climbing by means of tendrils. Leaves opposite, compound, consisting of two opposite, stalked leaflets and a terminal unbranched tendril. Leaflets about 3 in. long, but may be longer, elliptic-oblong or ovate-acuminate

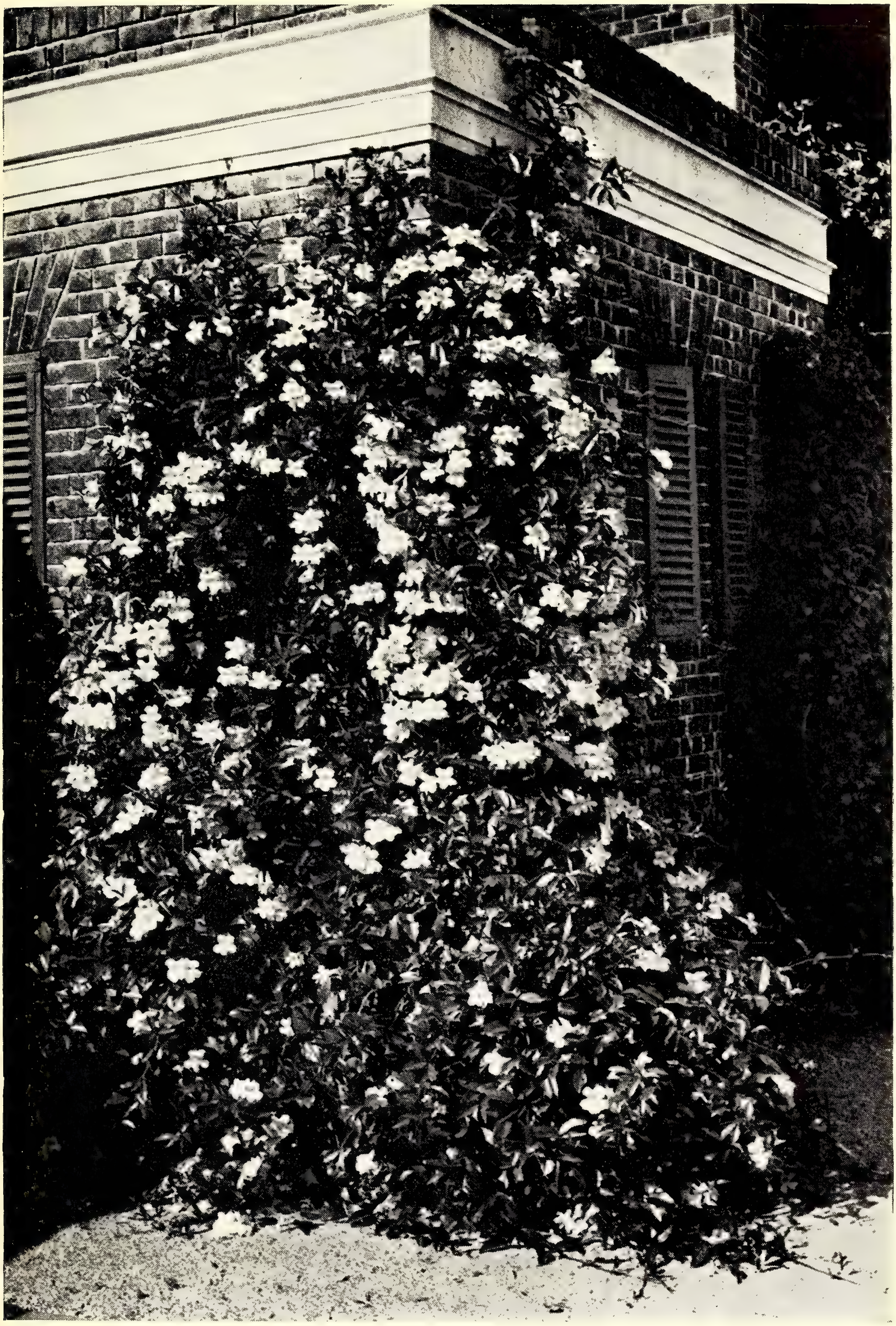

Photo by N. L. Bor.

Bignonia speciosa. R. Grah.
New Forest, Dehra Dun.

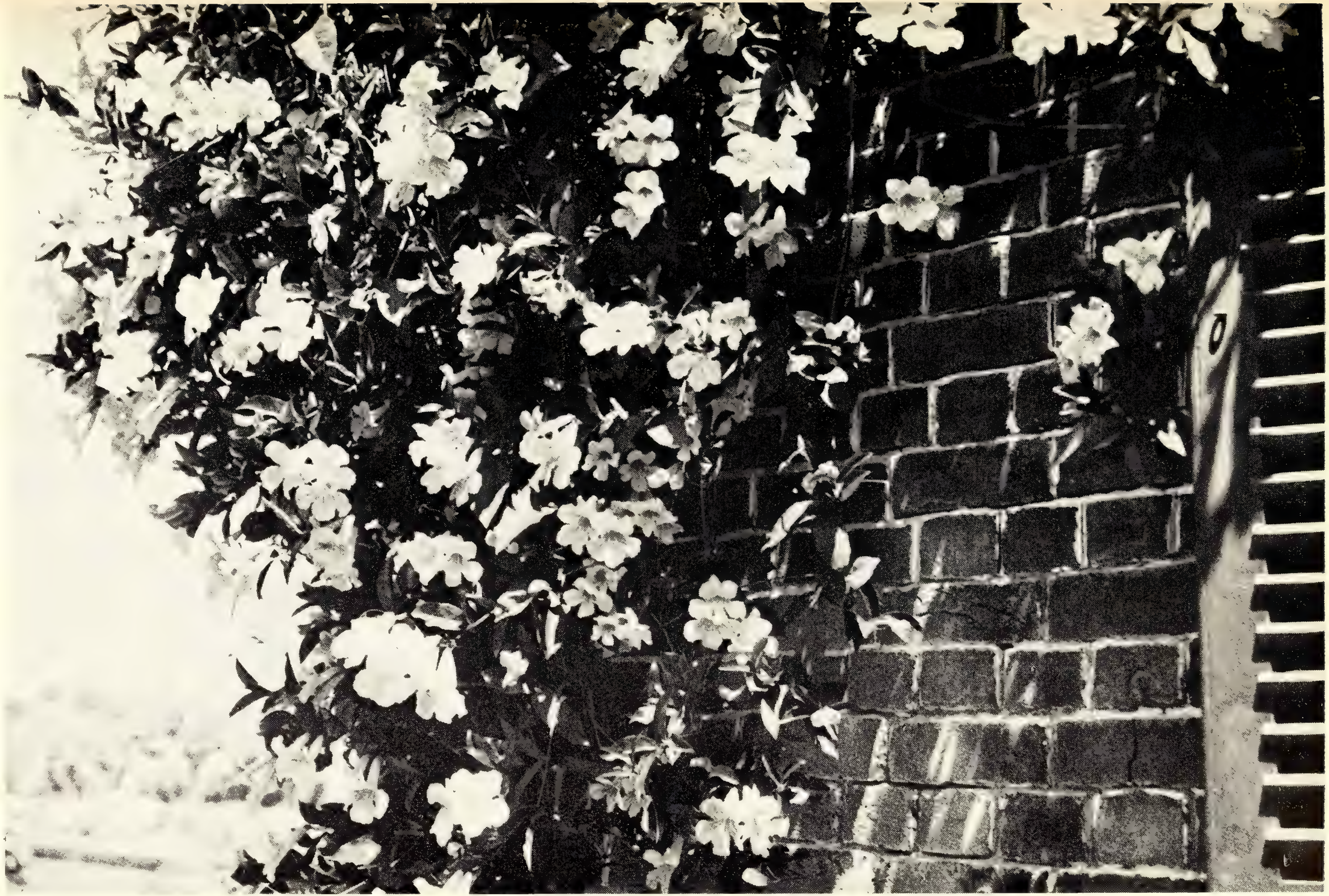

Photo by N. L. Bor.

Bignonia speciosa. R. Grah.
New Forest, Dehra Dun.

in shape, glabrous, shining, reticulated below; margins undulate; base subcordate, rounded or acute.

Flowers large and showy, borne in pairs on a terminal peduncle. Calyx obliquely campanulate with 5 acute or subulate lobes. Corolla pubescent, about 3 in. long, limb 3 in. broad, broadly ventricose from a short yellowish tube, lilac rose or pale purple in colour, streaked inside with darker purple veins. Lobes five, broadly ovate or orbicular, the upper reflexed. Ovary seated on a fleshy disk with crenulate margins. Stamens included, didynamous; anther cells much divaricate. Pod 2·5 in. long, shortly oblong, densely covered with short spines.

Flowers.—March—April. *Fruits.*—Cold season.

Distribution.—Indigenous to tropical America, but now widely cultivated in the tropics of both hemispheres.

Gardening.—This is a very showy and ornamental species best suited for training over trellis work or over fences and the like. Easily raised, like most other species of the genus, by layers.

Bignonia magnifica Bull. [**Arrabidaea magnifica** (Bull.) Sprague].

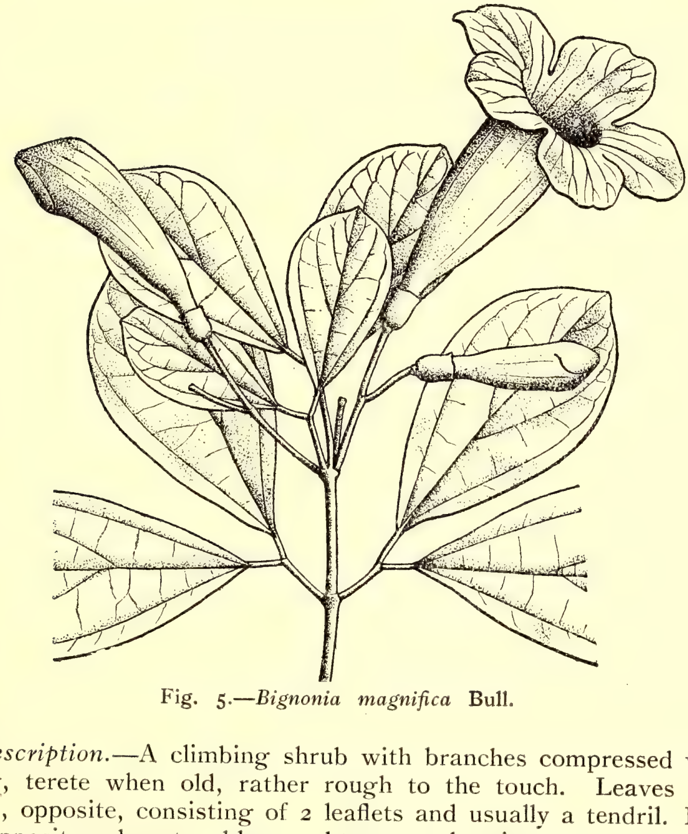

Fig. 5.—*Bignonia magnifica* **Bull.**

Description.—A climbing shrub with branches compressed when young, terete when old, rather rough to the touch. Leaves compound, opposite, consisting of 2 leaflets and usually a tendril. Leaflets opposite, obovate oblong, obtuse at the tip, attenuate at the base, rather dull on both surfaces, 3-5 in. long by 1·75-2·5 in. wide, membranous, glabrous, entire, with a short petiolule ·1 in. long; nerves compressed above, prominent below. Tendril issuing between the leaflets, hooked, up to 6 in. long.

Inflorescence of four-flowered, axillary or terminal, cymes. Flowers large, showy, almost sessile. Calyx gamosepalous, cupular-campanulate, very slightly narrowed above, olive green, truncate at the top or with a few teeth, shining within, dull without. Corolla large, up to 2·5 in. wide across the limb, purplish violet, mauve or light purple in colour, whitish or primrose in the throat with longitudinal purple veins. Tube tubular-infundibuliform, curved above the base, 2·5 in. long, 5-lobed, lobes orbicular, almost 1 in. in diameter. Stamens 4, didynamous, fifth a rudimentary stipe; filaments curved, inserted at the top of the narrow portion of the tube, swollen at the base and glandular, included; anthers widely divergent. Ovary superior, at the base of the tube; style 1-1·5 in. long with 2 stigmatic lobes.

Flowers.—Cold season. Does not set fruit in India.

Distribution.—Indigenous in Colombia, South America; now commonly cultivated in all tropical countries in the open and under glass in temperate climes.

Gardening.—It is a free flowering handsome climber, bearing large flowers of a delicate mauve changing to rich crimson, with the throat of a light primrose colour. Suitable for growing on arches, pergolas and the like. Easily raised by layers or cuttings.

(*To be continued*).

THE HOG-BADGERS (*ARCTONYX*) OF BRITISH INDIA.

BY

R. I. POCOCK, F.R.S.,

British (Natural History) Museum.

(*With a text-figure*).

Hog-badgers are not found in Peninsular India, but although widely distributed to the north and east of the Bay of Bengal are nowhere plentiful. As E. H. Peacock remarked they are of rare occurrence in Burma. A few only were collected by the Mammal Survey in that country and both Crump and Baptista failed to secure them in Bhutan, Sikkim and Nepal.

No detailed description of them is necessary since their general characters are well known; and the different kinds are superficially very much alike, being mainly distinguishable by size, by the luxuriance of the coat and by minor variations in colour, both the coat and colour being seasonally variable and the pattern of the head hardly ever quite alike in any two individuals. The skull and teeth are also subject to very remarkable individual variations, the skull more particularly in the degree of development of air-cells in the bones of the forehead and hind-palate which may alter its shape profoundly and the last two upper teeth differ more in size and shape within subspecific limits than in any other mammal known to me.

The literature relating to the Hog-Badgers reveals great divergence of opinion regarding the status and nomenclature of the many forms that have been described, chiefly on account of the varied application of the name *collaris,* symbolising the type-species of the genus *Arctonyx.*

In his account of the British Indian representatives Blanford, following Blyth, Anderson and W. L. Sclater, admitted two species, a larger, *A. collaris,* extending from the eastern Himalayas to Burma, and a smaller, *A. taxoides,* occurring in Assam and Arakan. Gray, however, had previously cited *taxoides* as a synonym of *collaris.* Wroughton, when dealing with the 'Survey' material, followed in 1914 Blanford's lead in adopting *taxoides* as the name for a valid species; but I have been unable to ascertain precisely what his conception of *collaris* was, except that he cited as representing it a ♀ specimen from Karenni, which is obviously immature, and another, which I have not seen, from the Chin Hills. He inferred apparently from these that the total length of the skull does not exceed 135 mm. in *collaris,* whereas Blyth, Gray and

Blanford had included under that heading specimens with the skull surpassing 150 mm. in total length.

Accepting Wroughton's statement about the length of the skull in *collaris* and Anderson's erroneous assertion that the type of *isonyx* Horsfield came from Tibet, G. M. Allen, in his revision of the Chinese Hog-Badgers, took *collaris* for the name of a southern Chinese, Tibetan and N. E. Himalayan form, with a skull of approximately the length given by Wroughton and quoted as synonyms of it *albogularis* given by Blyth in 1853 to a Tibetan specimen and *obscurus* given by Milne Edwards in 1868-1874 to one from E. Tibet. Although Allen gave no opinion about the status of *taxoides* or of the larger Hog-Badger identified by Blyth, Gray, Blanford and others as *collaris*, I infer that he would have regarded them as representing merely subspecies of *collaris*, since he assigned the Chinese Hog-Badgers to two subspecies of that species. At all events Osgood, who accepted Allen's designation of *collaris*, assigned the large Hog-Badgers of Annam, Laos, and the Malay Peninsula to a subspecies for which he adopted the name *A. collaris dictator*, Thomas.

Although there is not as yet, so far as I know, complete evidence of the intergradation of all the forms of Hog-Badger, I adopt the conclusion of my American colleagues that there is in Continental Asia but one species, *A. collaris*, represented by several subspecies; but I differ from them in the assignation of some of the names.

It has probably been my good fortune to see more examples of Hog-Badgers than any of my predecessors. The British Museum contains skins and skulls of all the described forms, except the north Chinese race *leucolæmus*. In addition it has been my privilege to examine the specimens in the Museum of the Bombay Natural History Society and in the Indian Museum, Calcutta and I am greatly indebted to the authorities of these institutions for the kind loan of them, especially to Dr. Baini Prashad, the Director for sending me the type of *taxoides* from Calcutta.

My conclusions regarding the British Indian Hog-Badgers is that there are two distinguishable races, a smaller, *collaris*, and a larger for which a new name seems necessary, although it contains specimens erroneously, in my opinion, assigned to *collaris* by several previous authors. The two may be briefly distinguished as follows:

(*a*) Size small, head and body about 2 ft. long, condylobasal length of skull not known to reach 120 mm., less than 5 inches; teeth smaller. *collaris*.

(*b*) Size larger, head and body about 2½ ft. long, condylobasal length of skull over 150 mm., or 6 inches in length; teeth larger. *consul* subsp. nov.

Arctonyx collaris collaris F. Cuvier.

Arctonyx collaris F. Cuvier, *Hist. Nat. Mamm.*, pt. 51, pl., 1825 and of some subsequent authors but only in part; and not *Arctonyx collaris collaris*, G. M. Allen, *Amer. Mus. Novit.*, no. 358, pp. 10-11, 1929 and *Mamm. China and Mongolia*, p. 404, 1938.[1]

Arctonyx taxoides, Blyth, *Journ. As. Soc. Beng.*, 22, p. 591, 1853. Anderson, *Zool. Res. Yunnan*, p. 196, 1878; Blanford, *Mamm. Brit. Ind.*, p. 180, 1888; W. L. Sclater, *Cat. Mamm. Ind. Mus.*, pt. 2, p. 291, 1891.

Arctonyx isonyx (Hodgson MS.), Horsfield, *Proc. Zool. Soc.*, 1856, p. 398, pl. 1.

Arctonyx collaris taraiyensis, Hodgson, *Cat. Mamm. etc.* ed., 2, p. 7, 1863 (no description).

Locality of the type of *collaris*, 'the hills between Bhutan and India', cited by Wroughton as the Bhutan Duars; of *taxoides*, Assam; of *isonyx* and *taraiyensis*, the Sikkim Tarai.

Distribution.—The Sikkim Tarai, Bhutan Duars, Assam and perhaps Chittagong.

Distinguished from the other British Indian race, which apparently replaces it in Burma, by its smaller size, the head and body being only about 2 ft. long or less, shorter tail and smaller skull, the length of which is only about 120 mm. or less; also by its noticeably thicker winter coat. From the Southern Chinese race *A. c. albogularis* by its shorter, less thickened winter coat and smaller skull the length of which in *albogularis* is about 135 mm.

I have only seen four specimens that I assign to this race, namely the skin of the type of *isonyx*, from the Sikkim Tarai, an immature skin from Darjiling (Calcutta Museum), the skin and the skull of the type of *taxoides* from Assam and of a specimen, received from the East India Co., entered as from 'Bengal' but marked on its stand as from Chittagong which was formerly included in that Province.

The restriction of the name *collaris* to this small Hog-Badger is based on the assumption that the type specimen from Bhutan Duars is probably racially the same as that of the type of *isonyx* from the Sikkim Tarai. I have seen no specimens from Bhutan and am not aware of a record of one from that district apart from Cuvier's account based on a description sent to him by Duvaucel of a living specimen exhibited in the menagerie at Barrackpore and stated to have been brought from the 'hills between Bhutan and India'. The type was probably not preserved and no measurements were given. But the skin of the type of *isonyx* is in the British Museum and in Hodgson's MS., where the specimen is said to have come from the Sikkim Tarai, there is a fairly good figure of the skull which from its muscular moulding appears to be adult. Its measurements, entered below, are taken from these drawings said to be two-thirds natural size. I have also seen the type, skin and skull, of *taxoides.* There is nothing that I can detect in the skin, as preserved, to separate it systematically from that of *isonyx,* although the ears, as stated by Blyth, seem to be a little smaller; and I do not attach to the cranial and dental characters, relied on by Blyth, Anderson and W. L. Sclater, the importance assigned to them by those authors. In the first place the skull is not fully adult, as it was stated to be, its basioccipital and naso-maxillary sutures being open and its temporal ridges 15 mm. apart. It is moreover abnormal in being 'undershot', the lower incisors projecting 5 mm. beyond the upper. The upper carnassial is admittedly unusual in shape, as W. L. Sclater said, although Blyth noted nothing peculiar about it; but the upper teeth of *Arctonyx* vary so remarkably individually in the same locality that the peculiarity is not, in my opinion, to be relied upon on the evidence of a single specimen.

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[1] Since *collaris* is not, in my opinion, applicable to the Tibetan and Southern Chinese Hog-Badger, I adopt for that race the name *albogularis* Blyth, with *obscurus* Milne Edwards as a synonym; and, from an examination of the types, I entirely agree with Allen that the names *orestes* and *incultus* given by Thomas to Hog-Badgers from the Tsing Ling Mts., S. W. Shensi and from Chinteh in Anhwei respectively are also synonyms.

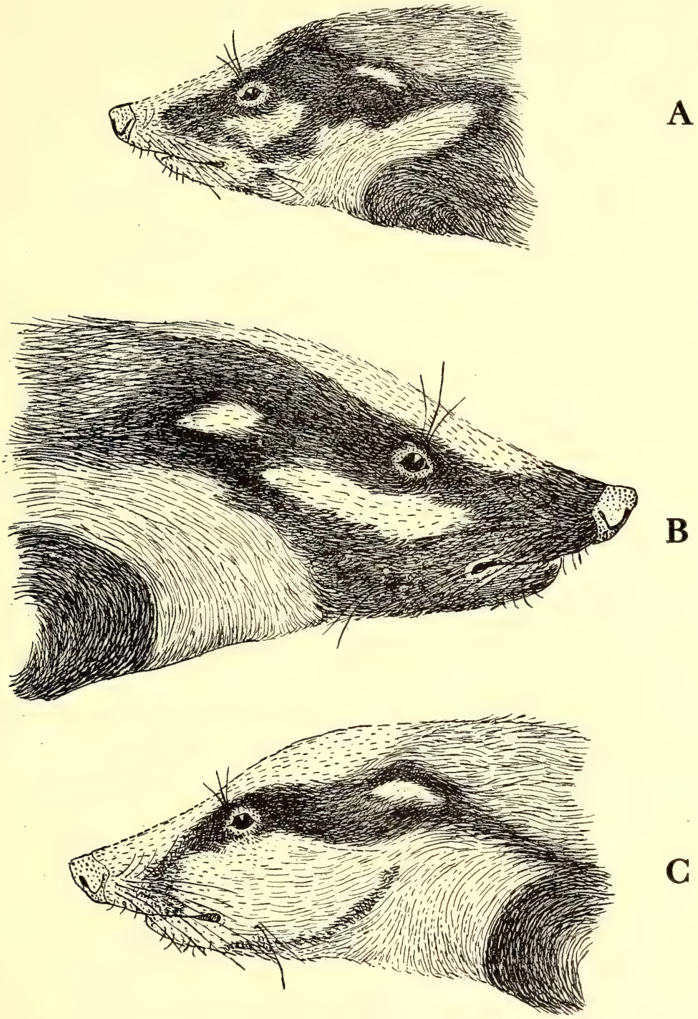
The external measurements in English inches of the specimens of this race were taken from dried skins, the type of *isonyx* is 'made up' in the conventional way from a formerly mounted specimen; that of *taxoides* is still mounted for exhibition. In these the dimensions were taken 'over the curves'. The third specimen from Bengal (? Chittagong) is now a flat skin, which was unstuffed a few years ago. They were probably stretched rather than shrunken by the manipulations to which they were subjected, which would make the dimensions of the head and body in life less rather than more than those indicated on the table.

The external measurements in English inches of *A. collaris collaris,* taken from skins, and of *A. c. consul,* taken in the flesh, are as follows:—

Name, locality and sex		Head and Body	Tail	Hind foot
A. collaris collaris				
Sikkim Tarai (*isonyx*, type)	ad. ♀	25	5	3
Assam (*taxoides,* type)	sub. ad. ♀	22¼	5½	3
Bengal (Chittagong)	just ad. ♀	21½	4½	3
A. c. consul				
Thaundaung, nr Toungoo (type)	ad. ♂	31	10⅕	4⅗
Thaundaung, nr Toungoo	yg. ad. ♂	25⅗	9⅘	4⅗
Moulmein (Tickell, MS.)	ad. ♂	30	9	4⅜

Arctonyx collaris consul subsp. nov.

Arctonyx collaris of Horsfield, Blyth, Gray and also of Blanford, *Mamm. Brit. Ind.* p. 178, 1888 (excluding *isonyx* Hodgs. from synonymy); but not typical *A. collaris,* as identified above, nor *A. collaris collaris* G. M. Allen, *Amer. Mus. Novit.,* no. 358, p. 10, 1929.



A. Head of *Arctonyx collaris collaris,* drawn from the type of *taxoides.*

B. Head of *Arctonyx collaris consul,* drawn from the skin from Longpa in the Naga Hills in which the black of the 'mask' is exceptionally well developed.

(*These two figures show approximately the relative size of the head in the two British Indian races of the Hog-Badger.*)

C. Head of *Arctonyx collaris consul* drawn from the skin from Lockaw, Karenni, to illustrate the greatest reduction in the black of the 'mask' in the available specimens of the race.

Locality of the type:—Thaundaung near Toungoo, 4,500 ft. in Lower Burma (J. M. D. Mackenzie).

Distribution.—Assam, Chittagong, Burma at least from Mogok to N. Tenasserim.

Distinguished from *A. collaris collaris* by its considerably larger size both in the head and body and in the skull, by its longer tail which is about one-third the length of the head and body and about twice the length of the hind foot and at least in its typical form by its less luxuriant winter coat. It is also larger than the Southern Chinese and Tibetan race *A. collaris albogularis* Blyth (=*obscurus* M. Edw.) and has the winter coat much thinner; but it is smaller on the average both in its body dimensions and skull and has the tail relatively longer than in the provisionally admitted Annamese race, *A. collaris annæus* Thos.[1] and still smaller, in the skull, than the Malayan race *A. collaris dictator*.[2]

The following is a list of the localities of the specimens I assign to this race, with the altitudes, where recorded, and the collectors' names. The only specimens collected for the Survey were those secured by J. M. D. Mackenzie, H. W. Wells, and J. P. Mills; and the only other specimens in the British Museum are the one presented by E. W. Oates and a skull from 'Bengal' (Hardwicke). The rest are in the collections of the Indian Museum, Calcutta, and of the Bombay Natural History Society.

Moulmein (Tickell MS., specimen not preserved); Lockaw in Karenni, 2,500 ft. (E. W. Oates); Thaundaung, near Toungoo, 4,500 ft. and 30 miles N. W. of Kindat (J. M. D. Mackenzie); Ruby Mines, Mogok (H. C. Smith); Falam in the Chin Hills, 5,000 ft. (J. M. Wright), Chittagong Hills (J. Jarbo); Hot Springs in the Jaintia Hills, 2,400 ft. (H. W. Wells); Longpa in the Naga Hills, 3,000 ft. (J. P. Mills) and Assam (Capt. Bulter)[3].

The skins from Assam are immature, as shown by their skulls, and the age of the skin from the Chittagong Hills cannot be determined because it has no skull. This is unfortunate because it is precisely in those districts that Hog-Badgers intermediate in size between the two races here admitted may be found, if they exist. The ascription of these specimens to *A. c. consul* is therefore only an inference based on the size of the young skulls from Assam and of the skin from Chittagong. Possibly, however, the Assamese specimens, especially the one from the Naga Hills may belong to the Southern Chinese race, *A. c. albogularis,* which is nearly intermediate in size between the other two.

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[1] Thomas (*Ann. Mag. Nat. Hist.* (9) 7, p. 524, 1921) based on a young ♂ from Nhatrang, Annam. See also Osgood (*Field Mus. Nat. Hist. Zool.*, 18, p. 263, 1932) who made *annæus* a synonym of *dictator* and very likely correctly.

[2] Thomas (*Ann. Mag. Nat. Hist.*, (8), 5, p. 424, 1910) based on an old ♀ from Trang, in the Malay Peninsula.

[3] The specimen from N.-W. of Kindat was identified by Wroughton as probably referable to *A. c. collaris* (*Journ. Bomb. Nat. Hist. Soc.*, 24, p. 768, 1916). It is a male shown by its skull, which is 139 mm. in condylobasal length, to be obviously immature. In the note accompanying it Mackenzie, guided by Blanford's and Wroughton's nomenclature, stated that he secured examples of *collaris* and *taxoides* in the Kabaw Valley and inferred that both occur in the Chin Hills. The specimen he identified as *taxoides* mysteriously disappeared and never, as Wroughton regretfully remarked, reached the British Museum for examination. I suspect it was a still younger example of *consul*.

The external measurements of the two examples from Toungoo entered in the table (p. 464) were taken in the flesh by Mackenzie and those of the one from Moulmein by Tickell as recorded in his MS. For the evidence of the differences in the dimensions between this race and the earlier described *annæus* from Annam and Laos I am indebted to Dr. Osgood who in 1932 recorded those of a male from Laos and later kindly sent me (*in litt.*) those of three examples from Thateng in Annam. In these the head and body range from 36½ to 44 in., the average being from 9 to 10 in. greater than in *consul,* the tail from about 8½ to 9½ in., a little less than in *consul,* and the hind foot from 5 to 5 4/5 in. on the average about 1 in. longer than in *consul.* The flesh measurements of the type of *dictator* are very nearly the same as of *annæus.* The very considerable difference in the length of the head and body between *consul* and *annæus* are, in my opinion, too great to be assigned to individual variation or to be explained away by the 'personal equation' of the collectors or by different methods of measuring.

The differences in the size of the skulls is much less marked. In the three adult ♂ skulls of *consul* the condylobasal length varies from 152 to 154 mm. In three adult, unsexed specimens of *annæus* from Thateng, Annam, the same length, as Dr. Osgood informs me, is 159 mm., but in an old ♂ from Phong Saly, Laos, it is only 155 mm., as he recorded in 1932. On the other hand the condylobase in the ♀ type of *dictator* is 165 mm. and in another adult ♀ from Sai Yoke, S. W. Siam, it is 164. It is on the evidence of the larger size of these two ♀ skulls that I provisionally regard *dictator* as a distinct race from *annæus.*

Some structural features in the skulls of *consul* entered in the table may be noted. The ad. ♂ skull of the type has no trace of sutures and its sagittal crest is 8 mm. high. The actual length of the younger skull from Toungoo is uncertain because the beast was killed by a knock on the head which smashed the back of the skull, but the mandible is only 7 mm. shorter than in the adult, 102 mm. as compared with 109 mm. It has all the sutures open, no sagittal crest, the temporal ridges being 10 mm. apart at their nearest point close to the middle of the crown, and the zygomatic and mastoid widths are much less, the mastoids being respectively 92 and 83 mm. These differences are a question of age. Very noticeable, too, are the differences in the size of the teeth. Those of the type, it is true, are flattened by wear, but quite clearly they were much smaller, before being worn, than those of the younger specimen.

The skull from 'Bengal' (Hardwicke) belonged to the specimen represented by Gray as *Mydaus collaris* (Hardwicke's *Illustr. Ind. Zool.*, 1, pls. 6 and 7, 1830) and twice subsequently figured by him as *Arctonyx collaris* (*Proc. Zool. Soc.*, 1865, p. 681 and *Cat. Carn.* etc. p. 124, 1869). The exact locality of the specimen is quite uncertain; but it may be suspected to have come from one of the districts of the Province lying in those days to the east of the Bay of Bengal. It is very like the skull of the type of *consul* from Toungoo, but has a lower sagittal crest, only 3 mm. high, a lower-projecting, hooked mastoid process and bigger teeth, more like those of the young Toungoo specimen.

The precise dimensions of the skull from Moulmein are doubtful. They have been calculated from Tickell's figures stated to be 5/8 natural size. This makes the condylobasal length as entered, but according to Tickell the total length of the skull was 6¼ in. or 158 mm., and this happens to be the condylobasal length which in this skull alone of all I have seen exceeds the length from the occipital crest to the premaxillæ. If 158 mm. is correct, the skull is almost exactly the same length as those of *annœus* from Thateng, Annam, referred to above. In that case the Moulmein specimen was intermediate between the two races, not a surprising thing considering its locality.

The skull is also singular for the exceptional widths of the interorbital area and of the muzzle, which give an unusually massive look to its facial portion. It is highly possible, however, that the peculiarities above mentioned are due to this Hog-Badger having been reared in captivity, a condition known to produce profound effects on the skulls of many Carnivora. Tickell stated that he had the animal alive for two years after receiving it from a monastery where it had been kept as a pet from early cubhood.

All the ♀ skulls I have seen are immature. The largest from Falam in the Chin Hills (Bombay Museum), with an estimated condylobasal length of about 140 mm., has the postdental area of the palate greatly inflated by air-cells and the frontal region also elevated by the same factor. The skull from Lockaw, Karenni has the same regions similarly expanded, but the frontal area is also swollen laterally, the whole area being unusually wide as compared with the end of the muzzle. It is also remarkably 'undershot', more so than in the type of *taxoides,* the lower incisors overlapping the upper by 7 mm. The skull is smashed at the back but I estimate its condylobasal length to have been about 128 mm.; but judging from the length of the mandible, 93 mm., the normal condylobasal length would have been about 135 mm., making allowance for the abbreviation of the upper jaw which has resulted in the 'undershot' condition of the muzzle. The measurements of the very young ♀ skull from the Jaintia Hills, which has all its sutures open and its second teeth imperfectly erupted, have been entered for comparison with those of the adult or nearly adult skulls of *collaris* which are a trifle shorter in condylobasal length and well moulded muscularly.

SKULL MEASUREMENTS OF THE TWO BRITISH INDIAN RACES OF THE HOG-BADGER (*Arctonyx*).

Name, locality and sex	Total length	Cond. bas. length	Zygom. width	Post. Orb. width	Int. Orb. width	Max. width	pm^4	m^1	m_1
A. collaris collaris									
'Bengal' just ad. ♀	122	114	62	24	24	22½	7	13	14
Assam (*taxoides*, type) sub. ad. ♀	114	...	57	24	21	23	7	13	14
Sikkim Tarai (*isonyx*, type) ad. ♀	114½	110½	56	22½	22½	21⅓	6	13	14
A. c. consul									
Toungoo (type) ad. ♂	158	154	91	37	37	33	9½	15	17
Toungoo yg. ad. ♂	(158±)	...	83	...	37	33	10½	18	20
'Bengal' ad. ♂	157	152	93	35	36	33	10	18½	19
Moulmein (Tickell MS.) ad. ♂	152	153½	94½	35½	41½	40	9½	14½	19½
Karenni, Lower Burma yg. ♀	...	(128±)	74	41	36	29	9	14	14
Jaintia Hills, Assam very yg. ♀	122	118	57	32	32	24	9	15	15

THE BIRDS OF CENTRAL INDIA.

BY

SÁLIM ALI.

WITH NOTES BY HUGH WHISTLER.

PART II.

(Continued from page 106 of this Volume).

Picus xanthopygaeus (Grey). The Little Scaly-bellied Green Woodpecker.

Specimens collected: *Bhōpāl*: 66♂ 11-1-38 Sānchi.
Elsewhere not noted.
Rare.

Dryobates mahrattensis (Latham). The Yellow-fronted Pied Woodpecker.

Specimens collected: *Bhōpāl*: 23 ♂ 8-1-38 Sānchi, 76 ♂ 14-1-38 Dōdi, 196 ♂, 197 ♀ 25-1-38 Mathār. *Gwālior*; 287 ♀ 15-2-38 Kūno, 884 ♂ 19-9-38 Bāgh. *Indore*: 730 ♀ 27-8-38 Bijwār.
Elsewhere noted: *Gwālior*: Satanwāra, Narwar Fort, Sūrwāya, Bhind.

[As pointed out in the Eastern Ghats Survey (*J.B.N.H.S.*, xxxvii, 288) the recognition of 2 races of this woodpecker is only really feasible if birds from the extreme North-west and birds from the South of India are compared. This series can only be considered intermediate. 287 ♀ from Kūno (wing 103·5) would pass as a typical *aurocristatus*. No. 884 ♂ from Bāgh (wing 99 mm.) would pass as *mahrattensis mahrattensis*. But with them must be considered the 3 birds from Mhow collected by Briggs (*J.B.N.H.S.*, xxxv, 394) which were certainly intermediates, whilst the present Bhōpāl series (viz. 3 ♂♂ wing 105, 107, 101 mm., and 1 ♀ 101 mm.) are the size of *aurocristatus* and the colour of *mahrattensis*. H. W.]

Common. Nest-hole on underside of horizontal mango branch, about 4 ft. from ground, containing apparently half-grown chicks, 16 April (Bhind); both parents feeding. A specimen found dead under a tree after severe hailstorm overnight, Mathār 25 January.

Dryobates hardwickii hardwickii (Jerdon). The Southern Indian Pigmy Woodpecker.

Specimens collected: *Gwālior*: 859 ♂ 15-9-38 Amjhēra. *Dhār*: 800 [♀], 801 ♂ 6-9-38 Gūjri, 844 ♂ 11-9-38 Māndu.
Elsewhere noted: *Bhōpāl*: Mathār, Jaithāri.
Almost invariably present in mixed hunting parties that contain *Sitta castanea*.

Brachypternus benghalensis benghalensis (Linn.) The Golden-backed Woodpecker.

Specimens collected: *Bhōpāl*: 10 ♂ 7-1-38, 21 ♂ 8-1-38 Sānchi, 132 ♀ 18-1-38 Dōdi. *Gwālior*: 260 ♂ 12-2-38 Kūno, 642 ♂ 12-4-38 Chandēri. *Indore*: 695 ♂ 23-8-38 Bijwār.
Elsewhere noted: *Gwālior*: Gwālior Fort, Sūrwāya.
Fairly common.

Chrysocolaptes festivus (Bodd). The Black-backed Woodpecker.

Specimens collected: *Indore*: 749 ♀ 30-8-38, 750 ♂ 31-8-38 Chōral.
Elsewhere noted: Chandēri.

Iynx torquilla torquilla (Linn.) The European Wryneck.

Specimens collected: *Gwālior*: 301 ♀ 19-2-38, 318 ♀ 20-2-38 Kūno, 578 ♂ 29-3-38 Badarwās.

Elsewhere noted : *Bhōpāl* : Dōdi. *Dewas* : Near town.

Earliest date 23 September; latest 29 March. Usually solitary. Flight and habit of twitching wings on alighting very finch-like.

Thereiceryx zeylanicus caniceps (Franklin). The Northern Green Barbet.

Specimens collected : *Bhōpāl* : 200 ♂, 201 ♀ 26-1-38 Mathār. *Gwālior* : 623 ♀ 7-4-38 Chandēri.

Elsewhere not noted.

[Nos. 200 and 201 with wings of 116.5 (♂) and 115 (♀) respectively clearly belong to the race *caniceps*. No. 623 (♀ wing 121·5) from further north, however, is as one would expect, considerably closer to *T. z. kangrae* (cf. *J.B.N.H.S.*, xxxvii, 515) and is best regarded as an intermediate. H.W.]

Xantholoema haemacephala indica (Latham). The Indian Crimson-breasted Barbet.

Specimens collected : *Bhōpāl* : 67 ♀ 11-1-38 Sānchi. *Gwālior* : 384 ♀ 28-2-38 Satanwāra, 445 o? 8-3-38 Narwar Fort.

Elsewhere noted : *Bhōpāl* : Bhōpāl City, Jaithāri. *Gwālior* : Sūrwāya. *Indore* : Bijwār, Chōral. *Dhār* : Māndu.

Not common. Largest ovarian follicle of specimen 28 February 5 mm.

Cuculus canorus ssp. The Cuckoo.

Specimen collected : *Dhār* : 829 ♂ juv. 9-9-38 Māndu.

Elsewhere not noted.

[This young cuckoo is in juvenile plumage and agrees very well, allowing for the individual variation which is common in juveniles, with specimens of the dark phase from the Western Himalayas. It therefore presumably belongs to the typical form. It will be remembered that Briggs procured adult cuckoos at Mhow in June and July which, from the state of their organs, appeared to be breeding and it is quite likely therefore that this juvenile was hatched in the neighbourhood where it was collected—H.W.]

Hierococcyx varius (Vahl). The Common Hawk-Cuckoo.

Specimen collected : *Gwālior* : 868 ♀ juv. 16-9-38 Sardārpūr.

Elsewhere noted : *Gwālior* : Chandēri, *Indore* : Bijwār. *Dhār* : Gūjri.

Not noted in Bhōpāl or Gwālior between 4 January and 13 April when the first in Central India was heard and seen. Not common, but possibly overlooked when silent.

Cacomantis merulinus subsp.? The Plaintive Cuckoo.

No specimens.

Noted : *Indore* : Bijwār. *Dhār* : Gūjri, Māndu.

Silent and not observed between January and May.

Clamator jacobinus pica (Hempr. & Ehr.) The Pied Crested Cuckoo.

Specimens collected : *Dhār* : 852 ♂ 13-9-38 Māndū. *Gwālior* : 867 ♂ 16-9-38, 877 ♂ 17-9-38 Sardārpūr.

Elsewhere noted : *Dhār* : Gūjri, *Gwālior* : Gwālior Fort, Tānda near Bāgh. *Indore* : Bijwār, Chōral, Simrōl.

Not noted during the period from January to May. Fairly common in August/September. 877 was a young bird with imperfectly ossified skull. Testes of 852 6 x 4 mm.

Eudynamis scolopaceus scolopaceus (Linn.) The Indian Koel.

Specimens collected : *Gwālior* : 676 ♂ 19-4-38 Bhind. *Indore* : 767 ♀ juv. 1-9-38 Chōral.

Elsewhere noted : *Gwālior* : Shivpūri, Gūna, Rūthiai.

[No. 767 is a juvenile female and it has the characteristic blackish plumage, far darker on the upper parts, throat and breast than the adult ♀ which I have already remarked on (*Ibis*, 1937, p. 408) as being obviously a protective device to avoid wakening any suspicions in the foster parents.—H.W.]

Before the beginning of April only the high pitched *Kŭck-kŭck-kŭck* was heard and the birds were silent on the whole. The regular calls or crescendo 'songs'—*kū-oo, kū-oo* etc. were fairly common in April, and also heard in

August/September when they were not common and apparently on the wane. 676 had testes enlarged to 9×7 mm. A nearly full-fledged juvenile being fed by House Crows in nest on 23 August!

Taccocua leschenaultii leschenaultii Lesson. The Southern Sirkeer Cuckoo.

Specimens collected: *Bhōpāl*: 129 ♂ 18-1-38, 143 ♀ 19-1-38 Dōdi; 161 ♂, 162 ♂ Mathār. *Gwālior*: 469 ♂ 13-3-38 Narwar Fort. *Indore*: 720 ♀ 25-8-38 Bijwār.

Elsewhere noted: *Bhōpāl*: Jaithāri, *Gwālior*: Sūrwaya, Badarwās, Bhind, *Dhār*: Māndu.

[In *J.B.N.H.S.*, xxxv, 396 I identified two birds collected by the Rev. Frank S. Briggs as the Northern race *sirkee*, but they must now be considered afresh with the series obtained by the Survey. In colour the series is variable. In size, however (6♂♂ wing 146-157 mm., 2 ♀♀ wing 153-158 mm.) they are so much smaller than the largest *sirkee* (North Punjab 5 ♂♂ wing 160-166; 5 ♀♀ 160-167 mm.) that I feel they might be attributed to *leschenaultii*, although somewhat intermediate in character, even the Narwar bird.—H.W.]

Common. In dry stony grass-and-thorn jungle. 720 (25 August) with white-shelled oviduct egg.

Centropus sinensis parroti Stres. The Southern Crow-Pheasant.

Specimens collected: *Gwālior*: 403 ♂ 2-3-38 Satanwāra.

Elsewhere noted: *Bhōpāl*: Bhōpāl City and Environs, Sānchi, Dōdi. *Gwālior*: Kūno, Narwar Fort, Sūrwāya, Gūna. *Indore*: Indore City and Environs. *Dhār*: Gūjri.

[♂ wing 201 mm. Interscapulars black; lower wing coverts chestnut and black mixed.—H.W.]

Psittacula eupatria nepalensis (Hodgs). The Large Indian Paroquet.

Specimen collected: *Gwālior*: 271 ♀ 14-2-38 Kūno (Wing 205; tail 301 mm.).

Elsewhere noted: *Bhōpāl*: Mathār, Jaithāri. *Gwālior*: Narwar, Badarwās, *Dhār*: Māndū.

Breeding in January and February. Specimen (14 February) had soft ovarian eggs. Juveniles about a month old taken from hole in tree 25 January.

Psittacula krameri borealis Neum. The Eastern Rose-ringed Paroquet.

Specimens collected: *Bhōpāl*: 123 ♀ 18-1-38 Dōdi; 254 ♂ 2-2-38 Jaithāri.

Elsewhere noted: *Bhōpāl*: Bhōpāl City, Dewānganj, Sānchi, Mathār. *Gwālior*: Kūno, Satanwāra, Sūrwāya, Badarwās, Chandēri, Bhind, Bāgh. *Indore*: Indore City, Bijwār, Chōral, Mhow. *Dhār*: Māndu.

[The specimens are of course really intermediate but in measurement they just reach the minima of Punjab birds. I have already suggested (*J.B.N.H.S.*, xxxvii, 752) an arbitrary boundary between the 2 races at 20° N. latitude so these can be called *borealis*.—H.W.]

Common. Breeding in January and February. Ovary of 123 granular; testes of 254 19×8 mm.

Psittacula cyanocephala bengalensis (Forst.). The Eastern Blossom-headed Paroquet.

Specimens collected: *Bhōpāl*: 149 ♂, 150♀, 151 ♂, 152 ♀ 21-1-38 Mathār.

Elsewhere noted: *Bhōpāl*: Sānchi, Jaithāri. *Gwālior*: Satanwāra, Narwar Fort, Sūrwāya, Badarwās, Chandēri, Bhind, Sardārpūr, Bāgh. *Dhār*: Gūjri.

Common in dry teak and *kher* forest. Breeding or about to breed in January. Largest ovum of 150 2 mm. in diameter; testes of 149 7×5 mm.

Coracias benghalensis benghalensis Linn. The Indian Roller.

Specimen collected: *Bhōpāl*: 54 ♂ 10-1-38 Sānchi.

Elsewhere noted: *Bhōpāl*: Dōdi. *Gwālior*: Kūno, Satanwāra, Sūrwāya, Bhind.

[This ♂ with wing 188 mm. clearly belongs to the Northern race. This is another of those birds which intergrade from north to south and I have already suggested (*J.B.N.H.S.*, xxxvii, 755) that the division between the races should be arbitrarily fixed along 20° N. Lat.—H.W.]

Met with sparingly.

Merops orientalis orientalis Latham. The Common Indian Bee-eater.

Specimens collected: *Bhōpāl*: 175 ♂, 176 ♀ 23-1-38 Mathār. *Gwālior;* 544 ♀ 25-3-38 Badarwās.

Elsewhere noted: *Bhōpāl*: Bhōpāl City and Environs, Sānchi, Dōdi. *Gwālior*: Satanwāra, Narwar Fort, Sūrwāya, Badarwās, Amjhēra. *Indore*: Indore City and Environs, Bijwār, Chōral, *Dhār*: Gūjri.

Not uncommon, but curiously sparse and local. 544 had a granular ovary and on that date (25 March) a small colony was busy digging nest-tunnels in earth bank of Sind River.

Merops superciliosus javanicus Horsf. The Blue-tailed Bee-eater.

Specimens collected: *Gwālior*: 679 ♂ 19-4-38 Bhind. *Indore*: 787 ♂, 788 o? 5-9-38 Mandlēshwar. *Dhār*: 834 ♀, 835 ♂ 10-9-38 Māndu.

Elsewhere noted: *Gwālior*: Gwālior Fort, Amjhēra, Shivpūri. *Indore*: Mhow.

Not met with in Central India between 4 January and 19 April. Fairly common in August/September. Testes of 679 (19 April) 7×4 mm.; 788 (5 Sept.) young of the season with imperfectly ossified skull.

Ceryle rudis leucomelanura Reichenbach. The Indian Pied Kingfisher.

Specimens collected: *Bhōpāl*: 96 ♂ 15-1-38 Dōdi. *Dhār*: 818 ♀ 7-9-38 Gūjri.

Elsewhere noted: *Bhōpāl*: Sānchi, Bhōpāl Lake. *Gwālior*: Satanwāra, Gūna, Rūthiai, Chandēri. *Indore*: Bijwār.

Testes of 96 (15 January) 12×8 mm. Nest 4 February! Ovary of 818 (7 Sept.) granular.

Alcedo atthis taprobana Kleinschm. The Common Ceylon Kingfisher.

Specimen collected: *Bhōpāl*: 100 ♂ 15-1-38 Dōdi.

[This is a very blue specimen with a long beak (46 mm. from skull) which I cannot separate from *taprobana* of South India. There are 4 birds in the British Museum from Mt. Aboo which also seem to be very close to *taprobana*. Yet other specimens from localities like Neemuch, Poona, Saugor, Western Khandesh, Khandala and Matheran are *benghalensis*. The individual and subspecific differences of this species are very difficult to understand, partly because one so seldom meets with a series of known breeding birds from any area, and partly, no doubt, because being entirely dependent on water supply in which local rain and drought play such an important part, the individual's movements may be very erratic and outside of the ordinary rules of migration.—H.W.]

Alcedo atthis bengalensis Gmelin. The Common Indian Kingfisher.

Specimens collected: *Bhōpāl*: 31 ♀ 9-1-38 Sānchi. *Indore*: 747 ♂ 30-8-38 Chōral.

Elsewhere noted: *Gwālior*: Gūna, Rūthiai, Chandēri. *Indore*: Bijwār.

Singly or pairs at tanks and streams.

Ramphalcyon capensis gurial (Pearson). The Brown-headed Stork-billed Kingfisher.

Specimens collected: *Bhōpāl*: 134 ♀ 19-1-38 Dōdi. *Indore*: 721 ♂ 25-8-38 Bijwār.

Elsewhere noted: *Bhōpāl*: Bhōpāl Lake, Sānchi, Jaithāri. *Gwālior*: Kūno, Rūthiai, Chandēri (Panchamnagar).

Fairly common. Singly or pairs on wooded streams. Largest ovarian follicle of 134 (19 January) 2 mm. diam. Testes of 721 (25 August) 9×5 mm.

Halcyon smyrnensis smyrnensis (Linn). The White-breasted Kingfisher.

Specimens collected: *Bhōpāl*: 65 ♂ 11-1-38 Sānchi, 171 ♀ 22-1-38 Mathār. *Indore*: 748 ♀ 30-8-38 Chōral.

Elsewhere noted: *Gwālior*: Rūthiai, Chandēri (Panchamnagar). *Indore*: Bijwār.

Not uncommon.

Tockus birostris (Scopoli). The Common Grey Hornbill.

No specimens.

Noted: *Bhōpāl*: Sānchi, Jaithāri. *Gwālior*: Satanwāra, Sūrwāya, Amjhēra. *Indore*: Bijwār. *Dhār*: Māndu.
Common.

Upupa epops epops Linn. The European Hoopoe.

Specimen collected: *Gwālior*: 369 ♀ 27-2-38 Satanwāra.

[Wing 142·5 mm. and pale in colour, being evidently a migrant of the typical form.—H.W.]

Upupa epops ceylonensis Reichb. The Ceylon Hoopoe.

Specimen collected: *Bhōpāl*: 117 ♂ 17-1-38 Dōdi.

[Wing 131 and richly coloured; evidently belonging to the resident form.—H.W.]

Elsewhere noted (subspecies?): Bhōpāl City. *Gwālior*: Kūno, Gwālior Fort, Bhind, Shivpūri. *Dhār*: Gūjri.
369 had a granular ovary! On the same date another pair was interested in a hole in a masonry archway. On 17 April one was observed carrying food to nest.

Apus melba melba (Linn). The Alpine Swift.

Specimen collected: *Dhār*: 778 ♂ juv. 4-9-38 Gūjri.
Elsewhere noted: *Bhōpāl*: Jaithāri. *Gwālior*: Satanwāra. *Dhār*: Māndu.

[The specimen is a little small (wing 214 mm. ♂) for the typical race but it is certainly too pale for *A. m. bakeri* and it agrees with my series from N.-W. India. The skinner has noted on the label that the skull was soft and if this is correct the small size might be put down to its being a juvenile specimen. The wing is in moult, and according to the *Handbook of British Birds*, ii, 244, the wing is probably not moulted at the post-juvenal moult. Adult and juvenile Alpine Swifts are, however, very difficult to separate on plumage and it may be that the *Handbook* is wrong about the post-juvenal moult.—H.W.]

Small numbers usually seen hawking high over fired grass jungle. A colony (nesting?) about the enormous rock scarps and valley at Kānkra Kho, Māndu.

Apus affinis affinis (Gray). The Common Indian House-Swift.

Specimens collected: *Gwālior*: 481 ♀, 482 ♂ 14-3-38 Narwar Fort. *Indore*: 742 ♀ 30-8-38 Chōral.
Elsewhere noted: *Gwālior*: Satanwāra, Chandēri, Gwālior Fort. *Indore*: Bijwār, Mahēshwar. *Dhār*: Gūjri, Māndu. *Bhōpāl*: Bhōpāl city, Mathār, Jaithāri.
Common.

Hemiprocne coronata (Tickell). The Indian Crested Swift.

Specimens collected: *Bhōpāl*: 164 ♂, 165 ♂, 166 ♀, 167 ♀ 22-1-38 Mathār, 199 ♀ 25-1-38. *Indore*: 745 ♂, 746 ♀ 28-8-38 Chōral.
Elsewhere noted: *Bhopāl*: Jaithāri. *Gwālior*: Chandēri. *Indore*: Bijwār.
Gonads of January specimens maturing. ♂ ca 7×5 mm.; ♀ largest ovum 2 mm. Patchy, but not uncommon. Usually over teak and dry forest.

Caprimulgus indicus indicus Latham. The Indian Jungle Nightjar.

Specimens collected: *Gwālior*: 644 ♂ 12-4-38 Chandēri.
Testes 5×4 mm. Chasing and courtship in progress.

Caprimulgus monticolus monticolus Franklin. Franklin's Nightjar.

Specimens collected: *Bhōpāl*: 52 ♀ 10-1-38 Sānchi. *Gwālior*: 399 ♀ 28-2-38 Satanwāra, 484 ♂ 15-3-38 Narwar Fort.
Elsewhere noted: *Gwālior*: Chandēri.
Common. 399 breeding 28 February; largest ovum 5 mm. diam.

Caprimulgus asiaticus asiaticus Lath. The Common Indian Nightjar.

Specimens collected: *Bhōpāl*: 75 ♂ 14-1-38, 107 ♀, 108 ♂ 17-1-38 Dōdi. *Dhār*: 848 ♀ 12-9-38 Māndu.
Elsewhere noted: *Gwālior*: Narwar Fort, Chandēri.

[These specimens, as well as 2 in my collection obtained by Briggs at Mhow, all belong to the grey phase. No. 848 is undergoing a complete moult.—H.W.]

Common. Noisy March/April; silent August/September.

Tyto alba subsp.? The Barn Owl.

No specimens.

Noted only at Māndu, Dhār State, (Sept. 38) among ruins.

Asio flammeus flammeeu (Pontopp.) The Short-eared Owl.

Specimen collected: *Bhōpāl*: 112 ♂ 17-1-38 Dōdi.

Elsewhere not noted.

Solitary at base of bush in stony scrub country. Stomach contained field rat.

Strix ocellata (Lesson). The Mottled Wood-Owl.

No specimens.

Noted: *Bhōpāl*: Mathār. *Indore*: Bijwār, Chōral. *Dhār*: Gūjri.

Apparently not uncommon.

Ketupa zeylonensis leschenault (Temm.). The Bengal Brown Fish-Owl.

Specimen collected: *Gwālior*: 630 ♂ 8-4-38 Chandēri (Betwa River).

Elsewhere noted: *Bhōpāl*: Mathār. *Gwālior*: Sūrwāya.

Stomach of specimen contained remains of *Varanus* lizard, ca. 12 inches long.

At Mathār (Narbada Valley, Bhōpāl) was heard the long-drawn kite-like whistle of what I take to be some sort of owl. It was in a densely bamboo covered forested ravine. The bird never gave a glimpse of itself, but the call kept moving farther and farther away as approached. I have heard this same or a closely resembling whistle, confirmed to be emanating from some owl of about the size of a kite, in the Biligirirangan Hills on the Mysore-Coimbatore border.

Otus (bakkamoena?) The Collared Scops Owl.

No specimens.

The mellow *what?......what?* calls were heard in Gwālior State at Kūno, Narwar Fort and Chandēri.

Athene brama indica (Franklin). The Northern Spotted Owlet.

Specimens collected: *Bhōpāl*: 48 ♀ 10-1-38, 68 ♀ 11-1-38 Sānchi. *Gwālior*: 311 ♀, 312 ♂ 19-2-38 Kūno; 625 ♀ 8-4-38 Chandēri.

Elsewhere noted: *Bhōpāl*: Mathār, *Gwālior*: Gwālior City and Fort, Satanwāra, *Dhār*: Gūjri, Māndu.

[These specimens are intermediate in size and colour, but may be called *indica* under the arbitrary convention given in *J.B.N.H.S.*, xxxviii, 237.—H.W.]

Common. Ovary of 625 (8 April) granular.

Ninox scutulata lugubris (Tickell). The Indian Brown Hawk-Owl.

Specimen collected: *Gwālior*: 450 ♀ 9-3-38 Narwar Fort.

Elsewhere not noted.

Ægypius monachus (Linn.). The Cinereous Vulture.

A solitary bird observed on a high bank among the ravines of the Chambal River near Dhōlpūr (Gwālior boundary) 17-8-39. Unconfirmed.

Sarcogyps calvus (Scopoli). The Black or Pondicherry Vulture.

Noted: *Bhōpāl*: Sānchi, Mathār, *Gwālior*: Kūno.

Common. Singly or twos and threes at carcases.

Gyps fulvus fulvescens (Hume). The Indian Griffon Vulture.

Noted: *Bhōpāl*: Sānchi, Dōdi, Mathār. *Gwālior*: Kūno. *Dhār*: Māndu.

Near Māndu (Nālcha) are suitable cliffs said to be used by these vultures in winter for breeding.

Gyps indicus *subsp?* The Long-billed Vulture.
Noted : *Bhōpāl* : Mathār.
Common?

Pseudogyps bengalensis (Gmelin). The Indian White-backed Vulture.
Noted : *Bhōpāl* : Mathār; *Gwālior* : Kūno. *Dhār* : Māndu.
Common everywhere.

Neophron percnopterus ginginianus (Lath.). The Smaller White-backed Scavenger Vulture.
Noted : *Bhōpāl* : Sānchi, Dōdi, Mathār. *Gwālior* : Kūno, Satanwāra, Narwar Fort, Sūrwāya, Bhind.
Common all over Central India. 2 nests in main forks of large Banyan and Mango trees, 22 March, with birds brooding!

Falco subbuteo subsp.? The Hobby.
Noted : *Gwālior* : Kūno.

Falco chiquera chiquera Dauden. The Red-headed Merlin.
Specimens collected : *Gwālior* : 569 ♂, 570 ♀ 28-3-38 Badarwās.
Testes 5×3 mm.; ovaries granular. A pair. Stomachs contained 1 leg each with feathers and remains of *Prinia sylvatica.*

Falco tinnunculus tinnunculus (Linn.). The European Kestrel.
Specimens collected : *Bhōpāl* : 233 ♂ 31-1-38 Jaithāri. *Gwālior* : 402 ♂ 2-3-38 Satanwāra, 486 ♂ 15-3-38 Narwar Fort.
Elsewhere noted : *Gwālior* : Kūno, Sardarpūr.
First of the season 17 September. Not abundant; occasional singles.

Falco jugger Gray. The Laggar Falcon.
Noted : *Gwālior* : Badarwās, Bāgh.

Aquila rapax vindhiana Franklin. The Indian Tawny Eagle.
Specimens collected : *Bhōpāl* : 105 ♂ 16-1-38 Dōdi. *Gwālior* : 320 ♂ 20-2-38 Kūno, 442 ♂ 8-3-38 Narwar Fort.
Elsewhere noted : *Bhōpāl* : Sānchi, Mathār, Jaithāri. *Gwālior* : Kūno, Satanwāra, Bhind.
Common.

Hieraëtus fasciatus fasciatus (Vieillot). Bonelli's Eagle.
Noted : *Gwālior* : Ummaidgarh Falls (Pārvati River), Kūno, Chhipōn (near Gūna). *Dhār* : Māndu.

Nisaëtus cirrhatus cirrhatus (Gmelin). The Indian Crested Hawk-Eagle.
Specimen collected : *Gwālior* : 604 ♂ 2-4-38 Chhipōn (near Gūna).

Circaëtus ferox (Gmelin). The Short-toed Eagle.
Specimens collected : *Gwālior* : 255 ♂ 12-2-38 Kūno.
Testes 15×10 mm.

Haematornis cheela subsp.? The Crested Serpent-Eagle.
Noted : *Bhōpāl* : Mathār. *Gwālior* : Chandēri, *Indore* : Chōral.

Butastur teesa (Franklin). The White-eyed Buzzard-Eagle.
Specimens collected : *Bhōpāl* : 26 ♂ 8-1-38 Sānchi, 184 ♂ 24-1-38 Mathār.
Elsewhere noted : *Bhōpāl* : Jaithāri, Dōdi, *Gwālior* : Satanwāra, Narwar Fort, Sardārpūr. *Dhār* : Gūjri.
Not uncommon but sparingly. Occasional singles.

Haliaëtus leucoryphus Pallas. Pallas's Fishing Eagle.
Noted : *Gwālior* : Chambal River (Gwālior-Dhōlpūr boundary).

Haliastur indus indus (Bodd.). The Brahminy Kite.
Noted : Bhopāl Lake; *Indore* : Bijwār.
Uncommon.

Milvus migrans govinda Sykes. The Pariah Kite.

Noted : *Bhōpāl* : Bhōpāl City, Sānchi, Dōdi, Mathār. *Gwālior* : Gwālior City, Satanwāra, *Indore* : Indore City.

Common, especially in and about towns.

Elanus coeruleus vociferus (Latham). The Black-winged Kite.

Specimens collected : *Gwālior* : 467 ♀ 13-3-38 Narwar Fort, 490 ♀ 17-3-38 Surwaya.

Elsewhere noted : *Bhōpāl* : Mathār, Jaithāri. *Gwālior* : Kūno.

Sparse.

Circus macrourus (S. G. Gmelin). The Pale Harrier.

Specimen collected : *Bhōpāl* : 43 ♀ 9-1-38 Sānchi.

Elsewhere noted : *Gwālior* : Narwar Fort, Satanwāra, Amjhēra. *Dhār* : Māndu (or *pygargus?*).

First of season : 11 September.

Circus aeruginosus aeruginosus (Linn.). The Marsh Harrier.

Noted : *Bhōpāl* : Bhōpāl Lake ; *Gwālior* : Satanwāra, Badarwās.

Astur badius dussumieri (Temm.). The Indian Shikra.

Specimens collected : *Gwālior* : 468 ♀ 13-3-38 Narwar Fort, 599 ♀ 2-4-38 Gūna, *Indore* : 758 ♂ imm. 31-8-38 Chōral.

Elsewhere noted : *Bhōpāl* : Sānchi, Mathār, Jaithāri.

Ovary of 468 (13 March) granular.

Crocopus phoenicopterus chlorogaster (Blyth). The Southern Green Pigeon.

Specimens collected : *Bhōpāl* : 1 ♂ 7-1-38, 13 ♀ 8-1-38 Sānchi ; 241 ♀ 1-2-38 Jaithāri ; *Gwālior* : 541 ♂ 22-3-38 Sūrwāya.

Elsewhere noted : *Bhōpāl* : Mathār, *Gwālior* : Kūno, Narwar Fort. *Indore* : Chōral. *Dhār* : Māndu.

[No. 241 has the forehead washed with greenish and a band of greenish across the base of the tail, but it agrees with the rest of the series which lack these greenish markings, in having the yellow abdomen of typical *chlorogaster*. 2 ♂♂ wing 190-192 ; 2 ♀♀ 187-190 mm.—H.W.]

Common. Ovary of 241 (1 February) granular. Testes of 541 (22 March) 5×3 mm.

Columba livia subsp? The Blue Rock-Pigeon.

Specimens collected : *Gwālior* : 298 ♀ 17-2-38, 316 ♀ 20-2-38 Kūno.

Elsewhere noted : *Gwālior* : Satanwāra, Narwar Fort, Sūrwāya, Bāgh, *Dhār* : Māndu.

[2 ♀♀ wings 220, 220 mm. Both have the rump concolorous with the back. In colour and size these birds match my series from the Punjab, but until material is available from Southern India to allow the characteristics of true *intermedia* to be satisfactorily appreciated I can neither define the ranges or differences of *intermedia* and *neglecta* nor identify individual birds with any satisfaction.—H.W.]

Ovaries of specimens mature. Largest follicle 5 mm.

Streptopelia orientalis meena Sykes. The Indian Rufous Turtle-Dove.

Specimen collected : *Gwālior* : 577 ♀ 29-3-38 Badarwās.

Elsewhere noted : *Bhōpāl* : Mathār, *Gwālior* : Chandēri.

[This is the form which breeds in the N.-W. Himalayas, *vide* my discussion of the names and races in *J.B.N.H.S.*, xxxviii, 678—H.W.]

Streptopelia chinensis suratensis (Gmelin). The Indian Spotted Dove.

Specimens collected : *Bhōpāl* : 174 ♀ 23-1-38, 183 ♂ 24-1-38 Mathār.

Elsewhere noted : *Bhōpāl* : Sānchi, Dōdi, Jaithāri. *Gwālior* : Kūno, Satanwāra, Narwar Fort, Sūrwāya, Badarwās, Gūna, Chandēri, Bāgh. *Indore* : Bijwār. *Dhār* : Gūjri, Māndu. Absent from Bhind.

Common. Facies preferences of the various doves more noticeable in dry season. Nest with c/2 on 19 September (Bāgh).

Streptopelia senegalensis cambayensis (Gmelin). The Indian Little Brown Dove.

No specimens.

Noted: *Bhōpāl*: Sānchi, Dōdi, Jaithāri. Absent at Mathār. *Gwālior*: Gwālior Fort and Environs, Kūno, Satanwāra, Narwar Fort, Sūrwāya, Badarwās, Gūna, Bhind. *Indore*: Bijwār. *Dhār*: Gūjri, Māndu. Bāgh.

Common.

Streptopelia decaocto decaocto (Frivalszky). The Indian Ring Dove.

Specimens collected: *Bhōpāl*: 160 ♂ 22-1-38 Mathār. *Gwālior*: 296 ♂, 297 ♀ 17-2-35 Kūno.

Elsewhere noted: *Bhōpāl*: Sānchi, Dōdi, Jaithāri. *Gwālior*: Gwālior Fort and Environs, Satanwāra, Narwar Fort, Sūrwāya, Badarwās, Gūna, Bhind, Bāgh, *Indore*: Bijwār. *Dhār*: Gūjri, Māndu.

Common. Nests with c/2 and c/3 (!) respectively on 18 September (Bāgh).

Œnopopelia tranquebarica tranquebarica (Hermann). The Indian Red Turtle-Dove.

Specimens collected: *Gwālior*: 387 ♂ 28-2-38 Satanwāra; 475 ♂ 14-3-38 Narwar.

Elsewhere noted: *Bhōpāl*: Dōdi, *Gwālior*: Sūrwāya, Badarwās, Bhind. *Indore*: Bijwār.

The least common dove. Testes of 387 (28 February) 12×5 mm.

Pterocles exustus ellioti Bogdanow. The Common Indian Sandgrouse.

Specimens collected: *Bhōpāl*: 78 ♂ 14-1-38 Dōdi. *Gwālior*: 270 ♂ 14-2-38 Kūno.

Elsewhere noted: *Gwālior*: Ummaidgarh Falls (Pārvati River); Satanwāra, Sūrwāya.

Not uncommon.

Pterocles indicus (Gmelin). The Painted Sandgrouse.

Specimens collected: *Bhōpāl*: 179 ♀ 24-1-38 Mathār. *Gwālior*: 278 ♂ 15-2-38, 313 ♀ 20-2-38 Kūno; 390 ♂, 391 ♀ 28-2-38, 398 ♂ 1-3-38 Satanwāra.

Elsewhere noted: *Gwālior*: Narwar Fort.

Not uncommon in dry forest. Gonads of January and February specimens enlarged, but not fully mature.

Pavo cristatus Linn. The Common Peafowl.

Noted: *Bhōpāl*: Sānchi, *Gwālior*: Kūno, Narwar Fort, Gwālior Fort and Environs, Bhind and elsewhere. *Indore*: Bijwār.

Protected by law in Gwālior and Indore, consequently very abundant and tame; commonly about villages.

Gallus sonneratii Temm. The Grey Jungle-fowl.

Strangely enough not met with or heard at all although the biotope seemed eminently suitable. I have only one doubtful sight record of a hen from Mānpūr (Indore). It is said to occur in parts of Bhōpāl State and in the portion of Indore State lying in the Sātpuras south of the Narbada River.

Galloperdix lunulata (Valenc.). The Painted Spur-Fowl.

Specimens collected: *Bhōpāl*: 7 ♀ 7-1-38 Sānchi; *Gwālior*: 456 ♀, 457 ♂ 10-3-38, 488 ♀ 15-3-38 Narwar Fort, 614 ♂, 615 ♂ 5-4-38 Bajranggarh (near Gūna), 622 ♀ 7-4-38, 632 ♀ 9-4-38, 638 ♂ 11-4-38 Chanderi.

Elsewhere noted: *Gwālior*: Kūno, Sūrwāya.

[Nos. 457, 614, 615, 638 are all adult males, with 2 large spurs on each leg and no sign of moult, yet I find considerable variation on the wings which does not seem to have been recorded. These vary from a bird like No. 457 which has so much metallic green on the wing coverts that the chestnut is only visible on the outer half of the wing coverts (viewed *en masse*) and even there a considerable part of the feathers are glossy green, to a bird like No. 614. In this the wing coverts are practically all chestnut with the metallic green confined to inconspicuous tips on many of the feathers. There is similar variation in the amount of metallic green on the scapulars and central back. In both varieties the white spotting persists. I see no evidence that this variation has any connection with age.

The other 5 birds are all apparently adult females and the variation in their plumage is trifling, confined to the brightness of the head markings and the presence or absence of shadowy lunate marking on the tips of the breast feathers. The spurs are one on each leg (twice), 2 on one and 1 on the other, and 2 on each leg (twice). No specimen shows any trace of moult.

Narwar is the most north-westerly locality from which I have seen this species.

Measurements :	Bill	Wing	Tail
4 ♂♂	23-24·5	153-167	120-129 mm.
5 ♀♀	22-23	150-157	107-128 mm.

These are slightly larger than the specimens obtained in the other surveys.—H.W.]

Not uncommon. Frequents stony *Anogeissus* covered hummocks and overgrown fort ruins. All the specimens of March and April had maturing gonads. Largest ovarian follicle of 632 (9 April) 4 mm. in diam. ; testes of 638 (11 April) 10×6 mm.

Excalfactoria chinensis [chinensis (Linn.)]. The Blue-breasted Quail.

Not met with, but a bunch of feathers picked up in grass and teak forest at Manthār (Bhōpāl State) 22 January.

Coturnix coturnix coturnix (Linn.). The Common or Grey Quail.

Specimens collected : *Bhōpāl* : 147 o? 19-1-38 Dōdi ; *Gwālior* : 349 ♂ 25-2-38 Satanwāra.

Elsewhere not noted.

Distinctly uncommon.

Coturnix coromandelica (Gmelin). The Black-breasted or Rain Quail.

No specimens.

Noted : *Bhōpāl* : Dōdi ; *Gwālior* : All along motor road from Gwālior to Shivpūri in grassy country (August/September) ; *Indore* : Bijāsan Ramna near Indore City ; *Dhār* : Grass fields near Jhira Palace (Dhār City).

Calling on every side during August/September.

Perdicula asiatica asiatica (Latham). The Jungle Bush-Quail.

Specimens collected : *Bhōpāl* : 27 ♀ juv. 8-1-38 Sānchi ; 130 ♀, 131 ♀ pull, 14-1-38 Dōdi ; 237 ♀ 1-2-38 Jaithāri. *Gwālior* : 314 ♂ 20-2-38 Kūno ; 422 ♂, 423 ♀, 424 ♂, 425 ♀ 6-3-38, 431 ♂ 7-3-38 Narwar Fort ; 878 ♂ 19-9-38 Bāgh ; *Dhār* : 847 ♂ 11-9-38 Māndu. The birds from Northern Gwalior are not quite typical.

[The two species of Bush-Quail of the genus *Perdicula* have always given observers and writers trouble because of the superficial similarity between the plumages of the 2 species, because of the difficulty of understanding the plumage sequences without a good deal of material and that specially collected *ad hoc*, and finally because of the fact that the distributions of the two species largely coincide. It was also unfortunate that at an early stage in the recorded history of the 2 species the theory was propounded that the 2 species were found on different types of terrain, for this idea has been repeated again and again without careful verification and I believe that it will be found to be largely or entirely incorrect. A belief in it has, however, coloured most of the accounts of the species.

It remained for Mr. Stuart Baker in his review of this genus (*J.B.N.H.S.*, xxix, p. 310) to take a short-cut out of all these difficulties by propounding the superficially attractive theory that the 2 birds *asiatica* and *argoondah* were races of one species. This theory I examined at some length in the Eastern Ghats Survey review (*J.B.N.H.S.*, xxxviii, 685) and there I showed—at any rate to my own satisfaction—that the theory could not be accepted and that there were certainly two species, one of which at any rate had its own races. Attention having thus been attracted to the problem, I was fortunate in being able to assemble further fresh material through the kindness and activity of Mr. H. W. Waite, Mr. E. A. D'Abreu and Col. R. Meinertzhagen, and now finally but very far from least, Mr. Sálim Ali. The result has been to clear up matters still further.

When writing the Eastern Ghats review I could not understand the plumages of the two species and so worked on a very conservative basis, not being sure whether the differences observed in the British Museum series were individual or racial or how far reliance could be placed on the sexing of the various specimens. The new material however, and particularly the fine series of both species collected in this survey, has given me a very good (though not yet quite complete) idea of the plumage sequences of the two forms and I am now able to add to the very cautious conclusions originally ventured upon.

In the first place *argoondah,* with its more limited distribution, can now be seen to have two races: *argoondah* and *meinertzhageni* (*Bull. B.O.C.*, ccccvii, p. 9—type locality Nasirabad). In the second place it is clear that the three races of *asiatica* recognised in the Eastern Ghats Survey are not sufficient. This species, with its small size for a Galline bird and its habit of making exceedingly short flights even when disturbed, is sedentary beyond the average of its family and there is nothing surprising therefore in its having developed a number of races.

In the Eastern Ghats Survey I recognised three races of *asiatica,* namely the typical race, the red race *vidali* from South Konkan and *ceylonensis* from Ceylon, at the same time hinting that this might not be sufficient. Since then I have described the pale north-west race *punjaubi* (*Bull. B.O.C.* type locality Ambala). The present series has helped to emphasize what was not clear before-or at least which I did not dare recognise until the plumages were more clearly understood—that the typical race is a dark blackish-looking bird, most clearly differentiated on the one hand from the red bird found below the Ghats in the South Konkan, and from the grey or sandy coloured bird found in other parts of India. These birds I have now separated as *punjaubi* but suspect that new material when it is forthcoming will show that South Indian birds again require separation both on size and colour. In the meantime it may be helpful to sketch roughly the plumages of this species:—

The chick is thus described by Ticehurst (*J.B.N.H.S.*, xxxi, p. 376) from a specimen of *P.a. punjaubi* collected by me in the Kangra District:

From base of bill over crown, down centre of back to tail, a broad chestnut band edged on each side with dark brown; outside this from base of bill a broad ochraceous supra-orbital stripe reaching nape and surmounting a narrow dark brown superciliary stripe; ear coverts and short moustachial streak dark brown. Rest of upper parts dappled rusty brown and light; underparts ochraceous-grey.

The juvenile plumage (sexes alike and described from a pair of *P.a.punjaubi* collected by me in Kangra District) is as follows:—A broad band down the centre of the crown brown edged with blackish-brown; a broad fulvous-white supercilium from the lores to the posterior edge of the ear coverts; cheeks and ear coverts dark brown with whitish shaft streaks; upper plumage warm sandy brown, the feathers of the hindneck, upper back and wing-coverts with conspicuous fulvous shaft streaks and broken blackish bars, the shaft streaks becoming broader on the scapulars and the bars becoming black patches on their inner webs; primaries dark brown mottled and streaked with sandy fulvous; secondaries, tertiaries and tail warm sandy brown with fulvous shafts and mottled, speckled and barred with fulvous and blackish-brown; lower plumage vinous-buff, the chin, throat and breast with shining white shaft streaks.

This juvenile plumage seems to be moulted rather gradually during the first winter giving place to the respective adult male and female plumages. As in other game birds the outer two or three juvenile primaries, more pointed in character than those which will succeed them, are apparently retained to the first post nuptial moult, but they are not always easy to recognise.

No. 27 in this series is a juvenile in the plumage described above but is throughout in a far darker, blackish-brown key, following and emphasising the sub-specific difference between the typical race and *punjaubi.*

The adult male and female are easy to recognise and are as usually described. The adult male has black and white barred underparts with a chestnut chin and throat. The female has vinous-brown underparts with a chestnut chin and throat. It must, however, be realised that some adult females have an adumbration of black and white barring on the lower throat and breast which must not be confused with the truly barred black and white feathers which will be found irregularly on juvenile males which have moulted some of their juvenile feathers.—H.W.]

Common. No. 27 (8 January) and 131 (18 January) were juvenile and pullet respectively. The birds were mostly paired off in August/September. Testes of 847 (11 September) 11×6 mm.; of 878 (19 September) 11×7 mm. On 19 September a pair was observed accompanied by half-grown pullets.

Perdicula argoondah argoondah (Sykes). The Rock Bush-Quail.

Specimens collected: *Indore*: 733 ♀, 734 ♂ 29-8-38 Bijwār.

Perdicula argoondah meinertzhageni Whistler.

Specimens collected: *Gwālior*: 392 ♀ 28-2-38 Satanwāra; 574 ♀, 575 ♂, 576 ♀ 29-3-38 Badarwās; 660 ♀ 17-4-38, 670 ♀, 671 ♂ 18-4-38 Bhind.

[The two birds from Indore State are very dark and agree beyond doubt with the typical race. The Gwālior series is not so uniform and four specimens (Nos. 392, 574, 660, 670) being in transition from juvenile to adult plumage, is not so easy to recognise. It is, however, certainly closer to *meinertzhageni*.

The adult plumage of this species is of course easily recognised from the corresponding adult plumages of *asiatica*. In the male the most marked characteristic is the dull brick-red chin and throat patch as distinct from chestnut. The female lacks the throat-patch altogether (in *asiatica* it is as distinct in the female as in the male) having the chin whitish and the throat concolorous with the rest of the lower plumage. The presence or absence of marking on the brown inner webs of the primaries is often cited as a distinguishing feature between the two species. It is correct that in *asiatica* the inner web is unmarked and this web is certainly as a rule barred or mottled or 'watered' with fulvous in *argoondah*, but it must be remembered that in some specimens the inner web is unmarked as in *asiatica*. These remarks only apply to the adult primaries. In both species the juvenile primaries are normally marked on the inner web. This character therefore must be used with great caution.

The chick of *argoondah* is as yet undescribed and I have seen no specimen of it.

The juvenile plumage may be thus described from a female in my collection of the race *meinertzhageni* from Nasirabad, the type locality: Crown and nape brown, barred with black, the feathers of the forecrown with pale shafts; supercilium extending beyond ear coverts pale creamy-fulvous; ear coverts and cheeks mixed buffy-brown and dark brown; remainder of upper plumage earthy-brown, the feathers speckled and broadly barred with black, and with fulvous shaft streaks, these markings becoming obsolescent on the rump and upper tail coverts, primaries, secondaries, tertiaries and tail warm sandy brown, barred and freckled on both webs with brownish-black, the tertiaries with broad fulvous shaft stripes and black blotches on the inner webs; chin vinous buff; remainder of lower plumage fulvous-buff, the throat, breast and to a less extent the flanks barred with blackish-brown, the feathers with white shafts.

It will be noticed that this juvenile plumage differs from that of *asiatica* in one most marked detail, that instead of being roughly unicolorous below with shining white shaft streaks, the throat and breast are barred with blackish, thereby superficially resembling the adult male. This explains why in this species one meets numbers of immature females which seem to have a mixture of male and female plumage below. The warm vinous-buff of the adult female underparts is, in these birds, mixed with barred black and white feathers which are remains of the juvenile plumage. Whereas on the other hand in *asiatica* the birds with mixed vinous-buff and black and white barred plumage are young males exchanging the vinous-buff juvenile plumage for the adult black and white bars. In the one case the black and white bars are juvenile feathers, in the other case adult feathers. The distinction is interesting and important, and essential to an understanding of the two species.—H.W.]

Common. Gonads developed between April and September.

Francolinus pictus (Jardine & Selby). The Painted Partridge.

Specimens collected. *Bhōpāl*: 77 ♀ 14-1-38, 142 ♀ 19-1-38 Dōdi; 212 ♀ 26-1-38 Mathār. *Gwālior*: 526 ♂ 21-3-38 Sūrwāya; *Dhār*: 850 ♂, 851 ♂ 12-9-38 Māndū.

Elsewhere noted: *Bhōpāl*: City Environs, Jaithāri. *Gwālior*: Kūno, Badarwās, Gūna, Rūthiai, Chandēri, Deharda-Isāgarh Road. *Indore*: Bijāsan Ramna (Indore City Environs), Bijwār, Mhow (around Bircha Lake).

[I cannot yet fully satisfy myself that there are two races of this species; nor can I obtain the necessary material to make out the plumages. The sexes can certainly not always be distinguished by plumage.—H.W.]

Common but not abundant. Breeding in September. Testes of 850 and 851 (12 Sept.) 19×12 and 17×11 mm. respectively. Local shikari asserted that male and female call alike.

Francolinus pondicerianus interpositus Hartert. The Northern Grey Partridge.

Specimens collected: *Bhōpāl*: 232 ♂ 31-1-38 Jaithāri. *Gwālior*: 317 ♀ 20-2-38 Kūno.

Elsewhere noted: *Bhōpāl*: Sānchi, Bhōpāl Lake Environs. *Gwālior*: Sūrwāya, Badarwās, Rūthiai, Barai (near Bhind), Gūna, Chandēri.

Common, but numbers much reduced in certain areas owing to excessive netting.

Breeding in March/April. Two broods of 2 or 3-day old chicks with parents on 19 April (Barai *Dalbergia* Plantation). One brood tended by 3 adults!

Turnix suscitator taijoor (Sykes). The Common Bustard Quail.

Specimens collected: *Bhōpāl*: 22 ♀ 8-1-38 Sānchi, 79 ♀ 14-1-38 Dōdi. *Gwālior*: 528 ♀, 529 ♀ 21-3-38 Sūrwāya.

Elsewhere noted: *Gwālior*: Kūno, Badarwās, Chandēri Fort. *Indore*: Bijwār. Dhār: Māndu.

Not uncommon. Ovaries of specimens 21 March granular.

Turnix dussumieri (Temm.) The Little Button-Quail.

Specimen collected: *Gwālior*: 294 ♂ 17-2-38 Kuno.

Elsewhere not noted.

Apparently not common.

Hypotaenidia striata gularis (Horsf.). The Indian Blue-breasted Banded Rail.

No specimens.

Noted: *Bhōpāl*: Bhōpāl Lake; *Gwālior*: Satanwāra (This species or *Rallus aquaticus*?).

Amaurornis phoenicurus chinensis (Bodd.). The Indian White-breasted Waterhen.

No specimens.

Noted: *Bhōpāl*: Sānchi, Bhōpāl Lake, Jaithāri (on Tendōni River); *Indore*: Bijwār.

Gallinula chloropus indicus *Blyth.* The Indian Moorhen.

No specimens.

Noted: *Gwālior*: Shivpūri, Narwar (Sind River), Chandēri.

Fulica atra atra Linnaeus. The Coot.

No specimens.

Noted: *Bhōpāl*: Bhōpāl Lake; *Gwālior*: Satanwāra.

Metopidius indicus (Latham). The Bronze-winged Jacana.

Specimen collected: *Bhōpāl*: 2 ♀ 7-1-38 Sānchi.

Elsewhere noted: *Gwālior*: Satanwāra, Chandēri, Panchamnagar, Rāmnagar Tank. *Bhōpāl*: Bhōpāl Lake.

Hydrophasianus chirurgus (Scopoli). The Pheasant-tailed Jacana.

Specimen collected: *Indore*: 792 ♂ juv. 5-9-38 Mandlēshwar (Chōli Tank).
Noted: *Bhōpāl*: Bhōpāl Lake, *Gwālior*: Satanwāra, Chandēri, Rāmnagar Tank (near Gūna), *Indore*: Chōral (Balwāda Tank), *Dhār*: Māndu.

[The specimen is a juvenile with little of the down plumage remaining. It may be described as follows:

Forehead, crown and nape chestnut; hindneck still in down, warm buff with greyish bases and bounded by a shadowy blackish line from the ear-coverts to the shoulders; upper and lower back and the scapulars dark brown, the feathers broadly bordered with deep rusty fulvous; rump and upper tail coverts dark brown, the feathers broadly tipped with deep rusty fulvous, this colour divided by a dark brown bar in some feathers; wing coverts dove brown, barred with darker brown and washed with fulvous, a broad white band down the edge of the wing; primaries and secondaries short and in quill, but it is possible to see that they will be as in the adult though the filaments at the tips of the first three primaries are not so fully developed; tail not yet visible; whole lower plumage white, the earcoverts, sides of the throat and the breast faintly washed with salmon pink, the breast dully spotted with sooty-black. The carpal spur of the wing is already evident.—H.W.]

Common. Several juveniles on 5 September and a c/2 resting directly upon floating singāra (*Trapa bispinosa*) leaves (Chōli Tank, Mandlēshwar, Indore).

Rostratula benghalensis benghalensis (Linn.). The Painted Snipe.

Specimen collected: *Gwālior*: 376 ♀ 27-2-38 Satanwāra.
Elsewhere noted: *Gwālior*: Chandēri.

Antigone antigone antigone (Linnaeus). The Sarus Crane.

No specimens.
Noted: *Bhōpāl*: Bhōpāl Lake, Sānchi (Gūlgāon Tank), *Gwālior*: Harsi Lake (Narwar Dist.). Sūrwāya, Chandēri; *Indore*: Chōral (Balwāda Tank), Mandlēshwar (Chōli Tank); *Dhār*: Māndu.

Common. Usually in pairs accompanied by sub-adult young—1 or 2—without red head. Nest in shallow reed-covered tank with c/2 on 11 September (Māndu).

Choriotes nigriceps (Vigors). The Great Indian Bustard.

No specimens.
Noted: *Gwālior*: Esāgarh.

Now said to be becoming increasingly rare in Gwālior territory and to be met with sparingly and rather sporadically in the following localities: Near Mohana; along Deharda-Esāgarh road in various spots; along Pāchchār-Esāgarh road near Sāruskhēri; west of Gwālior City near Tighāra Lake and Pagāra; near Jāura in Morena District; along portions of Shivpūri-Pōhri road. Greatly persecuted by shikaris and needs stringent protection.

Sypheotides indica (Miller). The Lesser Florican or Likh.

Specimens collected: *Indore*: 684 ♂ 21-8-38 Indore environs (Bijāsan Ramna); *Gwālior*: 871 ♂, 872 ♂ 17-9-38 Sardārpur (on Jhabua road, ca 4 m. from Rajgarh village).

The testes of the specimens—all in breeding plumage—measured 14×8, 12×5 and 8×4 respectively. They were busy leaping up into the air from time to time in nuptial display, and evidently preparing to breed.

Burhinus oedicnemus indicus (Salvadori). The Indian Stone-Plover.

Specimens collected: *Bhōpāl*: 8 ♀ 7-1-38, 49 ♂ 10-1-38 Sānchi, *Gwālior*: 565 ♂ 27-3-38 Badarwās.
Elsewhere noted: *Bhōpāl*: Dōdi, *Gwālior*: Kūno, Sūrwāya, Sardāpūr, Bāgh. *Dhār*: Gūjri.

Common. Often in flocks of 6 to 8. Vociferous during moonlit nights.

Esacus recurvirostris (Cuvier). The Great Stone-Plover.

Specimens collected: *Gwālior*: 329 ♂ 20-2-38 Kūno; 545 ♂ 25-3-38 Badarwās.
Elsewhere noted: *Gwālior*: Satanwāra, Narwar (Sind River), Chandēri (Betwa River).

Pairs on shingle banks and rocky beds of rivers. Testes of specimens 8×5 and 10×5 respectively.

Cursorius coromandelicus coromandelicus (Gmelin). The Indian Courser.

Specimens collected: *Gwālior*: 356 ♂, 357 ♀ 25-2-38 Satanwāra.
Elsewhere noted: *Gwālior*: Sūrwāya.
Not common. Gonads of specimens: ♂ 5×4 mm.; ♀ largest ovum 1 mm.

Gelochelidon nilotica nilotica (Gmelin). The Gull-billed Tern.

A single tern with black bill observed at Narwar (Sind River) on 14 March, flying steadily at great height due North, was evidently this species.

Sterna aurantia Gray. The Indian River Tern.

Specimen collected: *Gwālior*: 338 ♂ 24-2-38 Satanwāra.
Elsewhere noted: *Gwālior*: Gūna (Rāmpūra Tank), Chandēri.
Testes 7×5 mm.

Sterna melanogaster Temminck. The Black-bellied Tern.

Specimen collected: *Gwālior*: 612 ♀ 4-4-38 Gūna (Rāmpūra Tank).
Elsewhere noted: *Bhōpāl*: Dōdi.
Ovary granular.

Charadrius dubius curonicus Gmelin. The European Little Ringed Plover.

Specimen collected: *Bhōpāl*: 84 ♀ 14-1-38 Dōdi.

[This bird is still in immature plumage, but its measurements (bill from skull 17, wing 120·5, tail 63, tarsus 23 mm.) prevent me attributing it to anything but this race which is no doubt a winter visitor.—H.W.]

Charadrius dubius jerdoni (Legge). Jerdon's Little Ringed Plover.

Specimens collected: *Gwālior*: 327 ♀, 328 ♂ 20-2-38 Kūno, 413 ♂ 3-3-38 Satanwāra, 584 ♀, 585 ♂, 586 ♂ 1-4-38 Rūthiai; *Dhār*: 819 ♀ 7-9-38 Gūjri.
Elsewhere noted: *Gwālior*: Harsi Lake, Shivpūri.

[No. 819 is in juvenile plumage. The remainder are adults and from the state of their organs as recorded on the labels were doubtless on their breeding ground.

The series measures:	Bill from skull	wing	tail	tarsus
4♂♂	15·5-16·5	111·5-115	59-62	24-24·5 mm.
2♀♀	15·5-16·5	114-117	62·5-63·5	24-25 mm.

They evidently belong to the resident race which is commonly known as *Ch.d.jerdoni* though as I pointed out in the Eastern Ghats Survey, there are no specimens from Ceylon available to establish what that race is actually like and whether it is the same as Indian birds.—H.W.]

Gonads of specimens between 20 February and 1 April maturing. Testes averaging 5×3 mm; ovaries granular.

Lobivanellus indicus indicus (Boddaert). The Indian Red-wattled Lapwing.

Specimen collected: *Bhōpāl*: 221 ♀ 30-1-38 Jaithāri.
Elsewhere noted: *Bhōpāl*: Bhōpāl Lake, Sānchi. *Gwālior*: Kūno, Satanwāra, Shivpūri, *Indore*: Bijwār.
Common. In the rainly season commonly seen along the grassy edges of motor roads.

Lobipluvia malabarica (Boddaert). The Yellow-wattled Lapwing.

Specimens collected: *Bhōpāl*: 42 ♀ 9-1-38 Sānchi, 128 ♂ 18-1-38 Dōdi. *Gwālior*: 362 ♀ 26-2-38 Satanwāra.
Elsewhere noted: *Gwālior*: Kūno, Gūna, Rūthiai. *Indore*: Indore town outskirts. *Dhār*: Gūjri.
Not uncommon. Largest ovarian folicle of 362 (26 February) 3 mm.

Himantopus himantopus himantopus (Linn.). The Black-winged Stilt.

No specimens.
Noted: *Bhōpāl*: Dōdi; *Gwālior*: Satanwāra, Sūrwāya.
On village and irrigation tanks.

Tringa ochropus (Linnaeus). The Green Sandpiper.
Specimen collected: *Bhōpāl*: 60 ♀ 10-1-38 Sānchi.
Elsewhere noted: *Bhōpāl*: Bhōpāl Lake outskirts; Dōdi; *Gwālior*: Satanwāra, Narwar Fort, Sūrwāya, Badarwās, Chandēri; *Indore*: Bijwār, Chōral; *Dhār*: Gūjri.
Common in winter. Earliest date 26 August; latest 8 April.

Tringa stagnatilis (Bechstein). The Marsh Sandpiper.
No specimens.
Noted: *Bhōpāl*: Bhōpāl Lake; *Gwalior*: Satanwāra, Chandēri, Bhind.
Latest date 20 April.

Tringa glareola Linnaeus. The Wood Sandpiper.
Specimen collected: *Gwālior*: 503 ♀ 18-3-38 Sūrwāya.
Elsewhere noted: *Gwālior*: Chandēri.
Latest date 8 April.

Tringa hypoleucos Linnaeus. The Common Sandpiper.
Specimen collected: *Dhār*: 775 ♂ 3-9-38 Gūjri.
Noted: *Bhōpāl*: Sānchi, Dōdi, Bhōpāl; *Gwālior*: Satanwāra, Narwar Fort, Sūrwāya, Chandēri, Bhind.
Common. Last date 19 April.

Tringa erythropus (Vroeg). The Spotted or Dusky Redshank.
Specimen collected: *Bhopal*: 85 ♀ 14-1-38 Dōdi.
Elsewhere noted (this or *totanus?*): *Gwālior*: Satanwāra, Sūrwāya.

Glottis nebularia (Gunnerus). The Greenshank.
Specimen collected: *Bhōpāl*: 29 ♀ 9-1-38 Sānchi.
Elsewhere noted: *Bhōpāl*: Dōdi; *Gwālior*: Kūno, Satanwāra, Narwar (Sind River), Sūrwāyā, Rūthiai, Chandēri, Bhind; *Dhār*: Gūjri.
Earliest date 3 September; latest 19 April.

Erolia temminckii (Leisler): Temminck's Stint.
Specimens collected: *Gwālior*: 339 ♀ 24-2-38, 352 ♂ 25-2-38 Satanwāra.
Elsewhere noted: *Bhōpāl*: Dōdi; *Gwālior*: Harsi Lake.
Small flocks.

Capella gallinago gallinago (Linn.). The Common or Fantail Snipe.
Specimen collected: *Gwālior*: 378 ♀ 27-2-38 Satanwāra.
Elsewhere noted: *Gwālior*: Sūrwāya, Chandēri.
Latest date 8 April.

Capella stenura (Bonaparte). The Pintailed Snipe.
No specimens.
Noted: *Gwālior*: Satanwāra.

Lymnocryptes minimus (Brunnich). The Jack Snipe.
Specimen collected: *Gwālior*: 377 ♀ 27-2-38 Satanwāra.

Phalacrocorax carbo sinensis (Shaw). The Indian Large Cormorant.
No specimens.
Noted: *Gwālior*: Ummaidgarh Falls, Pārvati River.

Phalacrocorax niger (Vieillot). The Little Cormorant.
No specimens.
Noted: *Bhōpāl*: Sānchi, Dōdi, Bhōpāl Lake; *Gwālior*: Satanwāra, Narwar, Chandēri.

Anhinga melanogaster Pennant.
Specimen collected: *Gwālior*: 449 ♀ 9-3-38 Narwar Fort (Katōra Tāl).
Elsewhere noted: *Bhōpāl*: Sānchi, Jaithāri; *Gwālior*: Ummaidgarh Falls (Pārvati R.)
Indore: Mandlēshwar.

[The innermost tertiary and the tail-feathers show the stiff corrugations which are such a marked feature of this species and which presumably have some connection with its wonderful diving powers.—H.W.]

Nesting in company with *Ardea purpurea* and *Ardeola grayii* on Babūl in Sāngi Tank near Mandlēshwar. Several nearly full-fledged young on 5 September.

Platalea leucorodia Linnaeus. The Spoonbill.

No specimens.

Noted: *Bhōpāl*: Sānchi (Gūlgāon Tank); *Gwālior*: Satanwāra, Sūrwāya. Small flocks.

Threskiornis melanocephala (Latham). The White Ibis.

No specimens.

Noted: *Bhōpāl*: Sānchi; *Gwālior*: Satanwāra, Sūrwāya, Chandēri. Small parties.

Pseudibis papillosa (Temm. and Lang). The Indian Black Ibis.

No specimens.

Noted: *Bhōpāl*: Sānchi; *Gwālior*: Kūno, Satanwāra, Narwar, Chandēri, Bhind.

Pairs or small parties.

Ciconia ciconia subsp.? The White Stork.

No specimens.

Noted: *Gwālior*: Chandēri (3 or 4 on a tank, 8-4-38).

The only meeting in Central India.

Dissoura episcopus episcopus (Bodd.). The White-necked Stork.

No specimens.

Noted: *Gwālior*: Kūno, Harsi Lake, Rūthiai.

Large stick nest on top of bare *Bombax malabaricum* ca 40 ft. up, on river bank at Rūthiai 1-4-38. 1 bird brooding, the other perched on rim.

Xenorhynchus asiaticus asiaticus (Latham). The Black-necked Stork.

No specimens.

Noted: *Gwālior*: Kūno, Harsi Lake, Sūrwāya, Chandēri, Esāgarh.

Singly or pairs.

Ibis leucocephalus (Pennant). The Painted Stork.

No specimens.

Noted: *Bhōpāl*: Bhōpāl Lake; *Gwālior*: Kūno, Satanwāra, Harsi Lake, Narwar (Sind River). Small parties.

Anastomus oscitans (Bodd.). The Open-billed Stork.

No specimens.

Noted: *Gwālior*: Kūno, Satanwāra, Chandēri.

Singly or in small parties. Uncommon and excessively shy.

Ardea purpurea manillensis Meyen. The Eastern Purple Heron.

No specimens.

Noted: *Bhōpāl*: Sānchi, *Gwālior*: Satanwāra, Rāmpūra Tank (near Gūna), Chandēri; *Indore*: Mandlēshwar.

Nesting in company with *Anhinga* and *Ardeola* on Babūl in Sāngi Tank near Mandlēshwar, 5 September; several nearly full-fledged young awkwardly clambering about the branches.

Ardea cinerea (rectirostis Gould). The Eastern Grey Heron.

No specimens.

Noted: *Gwālior*: Kūno, Satanwāra, Narwar, Rāmpūra Tank (near Gūna), Bhind.

Solitaries.

Egretta alba subsp.? The Large Egret.

No specimens.
Noted : *Bhōpāl* : Dōdi ; *Gwālior* : Satanwāra.
Solitaries.

Egretta intermedia intermedia (Wagler). The Indian Smaller Egret.

No specimens.
Noted : *Bhōpāl* : Sānchi, Bhōpāl Lake ; *Gwālior* : Ummaidgarh Falls (Pārvati River), Narwar, Chandēri.

Egretta garzetta garzetta (Linn.). The Little Egret.

No specimens.
Noted : *Bhōpāl* : Bhōpāl Lake ; *Gwālior* : Narwar (Sind River), Chandēri.

Bubulcus ibiscoromandus (Boddaert). The Cattle Egret.

No specimens.
Noted : *Gwālior* : Narwar, Sardārpūr ; *Indore* : Mānpūr ; *Dhār* : Gūjri, Māndu.

Butorides striatus javanicus (Horsfield). The Indian Little Green Heron.

Specimen collected : *Bhōpāl* : 136 ♀ 19-1-38 Dōdi.
Elsewhere noted : *Bhōpāl* : Jaithāri (Tendōni River) ; *Gwālior* : Bajranggarh (near Gūna).

Ardeola grayii (Sykes). The Indian Pond Heron.

Specimen collected : *Gwālior* : 465 ♂ 12-3-38 Narwar Fort (Katōra Tāl).
Elsewhere noted : *Bhōpāl* : Bhōpāl Lake ; *Gwālior* : Satanwāra, Chandēri ; *Indore* : Mandlēshwar.
Common. Nesting in company with *Anhinga* and *Ardea purpurea* in Babūl in Sāngi Tank near Mandlēshwar, 5 September.

Phoenicopterus ruber roseus Pallas. The Flamingo.

No specimens.
Noted : *Indore* : Mandlēshwar (Chōli Tank).
4 birds flying high overhead, 5 September.

Sarkidiornis melanotos Pennant. The Nukhta or Comb-Duck.

Specimens collected : *Gwālior* : 491 ♂, 492 ♀ 17-3-38 Sūrwāya, 535 ♀ 22-3-38.
Elsewhere noted : *Bhōpāl* : Sānchi (Gūlgāon Tank) ; *Gwālior* : Chandēri (Panchamnagar).

[No. 535 is an immature bird differing from the adult female in having less gloss on the black parts of the upper plumage ; in having the white of the hindneck sullied with brown and barred with sooty-brown and black ; the lower back and rump are dull greyish-white, the feathers edged with brownish and the upper tail coverts and tail are brown without gloss.—H.W.]

The ovary of 535, however was conspicuously granular suggesting that the bird was going to breed shortly.
Fairly common. Small parties and flocks up to 25.

Nettopus coromandelianus coromandelianus (Gmelin). The Cotton Teal.

Specimens collected : *Dhār* : 827 ♀, 828 ♂ 9-9-38 Māndu.
Elsewhere noted : *Bhōpāl* : Sānchi (Gūlgāon Tank) ; *Gwālior* : Chandēri, Esāgarh ; *Indore* : Chōral (Balwāda Tank), Chōli Tank (near Mandlēshwar).
Fairly common in small numbers. Specimens a breeding pair. Testes of ♂ 29×18 mm. ; soft-shelled oviduct egg in ♀ measuring 40×29 mm.

Anser indicus (Latham). The Bar-headed Goose.

No specimens.
Noted : *Gwālior* : Along Shivpūri-Pohri road, 8 miles from the former.
A flock of about 50 on a tank, 11 February.

Dendrocygna javanica (Horsf.). The Lesser or Common Whistling Teal.
No specimens.
Noted : *Gwālior* : Chandēri ; *Dhār* : Māndu.
Small flocks up to end of April. A pair on 9 Sept.—evidently breeding.

Casarca ferruginea (Vroeg). The Ruddy Sheldrake.
No specimens.
Noted : *Gwālior* : Kūno, Satanwāra, Harsi Lake, Chandēri, Bhind.
Usually pairs. Once a flock of about 30. Latest date 19 April.

Mareca penelope (Linn.). The Wigeon.
No specimens.
Noted : *Gwālior* : Satanwāra, Chandēri (near Panchamnagar).

Nettion crecca crecca (Linn.). The Common Teal.
No specimens.
Noted : *Bhōpāl* : Bhōpāl Lake, Dōdi ; *Gwālior* : Kūno, Satanwāra.
Small parties on tanks.

Dafila acuta (Linn.). The Pintail.
No specimens.
Noted : *Gwālior* : Chandēri.
Several on tank.

Spatula clypeata (Linn.). The Shoveller.
No specimens.
Noted : *Gwālior* : Satanwāra.

Nyroca ferina ferina (Linn.). The Pochard or Dun Bird.
No specimens.
Noted : *Gwālior* : Satanwāra.

Nyroca rufa rufa (Linn.). The White-eyed Pochard.
No specimens.
Noted : *Bhōpāl* : Bhōpāl Lake ; *Gwālior* : Satanwāra.
The majority of duck on Bhopāl Lake (2 February) were of this species.

Nyroca fuligula fuligula (Linn.). The Tufted Pochard.
No specimens.
Noted : *Bhōpāl* : Bhōpāl Lake ; *Gwālior* : Satanwāra.

Podiceps ruficollis capensis Salvadori. The Indian Little Grebe.
Specimens collected : *Gwālior* : 497 ♀ 17-3-38 Sūrwāya, 530 ♀ 21-3-38.
Elsewhere noted : *Bhōpāl* : Bhōpāl Lake : *Gwālior* : Satanwāra ; *Dhār* : Māndu.
Fairly common. Ovaries of both specimens granular.

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(THE END)

A VISIT TO THE LACCADIVE ISLANDS.

BY

LIEUT.-COLONEL R. W. BURTON.

(*With four plates*).

In the minds of most people there will be some sort of romantic idea regarding coral islands. Blue lagoons, feathery palms, coral reefs, dusky beauties; all of these, with some reservation as to the latter, are to be found at Chetlat, a typical coral 'atoll' and the most northerly of the inhabited islands of the Laccadive archipelago.

It was at dawn on Friday, the 8th November 1935, that the writer crossed the bar of the Mangalore harbour in the 'Valia Bukkari' an *odam,* as the island coast-going vessels are termed, of 21 tons burthen. In length 37 feet with a draught of 5 feet 7 inches and a crew of 11 men there is in the whole of her construction not a single nail or bolt! The timbers are of the various trees which grow on the island, while the sweeps, used when becalmed, or to aid the rudder when going to another tack, are of coconut-palm wood. All the planks are secured by good joinery made fast by lashings of coir passed through holes bored to take them; even the rudder swings on hinges of coir rope. All the cordage is of island manufacture, and the rudely fashioned pulley blocks are made by the island carpenters. The mainmast is of teak from Indian forests, and the sixty-foot spar which carries the huge lateen sail is of mainland growth.

With a fair breeze from the land the mountains of the Western Ghats were out of sight by noon and we settled down to a voyage of uncertain duration. With luck we might do the 150 miles in three days or less, but with adverse winds or weather it might take thirteen. Such was the fate of one of these boats a year or so ago: thirteen days at sea to be driven ashore a hundred miles down the coast dismasted, rudderless, and all aboard in desperate straits for water. In view of such a happening we carried 40 gallons for our party of four, while the crew had their supply in a large earthenware vessel encased in coir-rope netting and slung below the leaf-thatched platform placed amidships as living and sleeping quarters for the crew. There also, on a floor of mud, is the cooking galley.

'Cabin accommodation' on the boat was a space beneath the poop nine feet wide and long narrowing to three feet at the stern-post, and two feet six inches high. When the vessel felt the first heave of the ocean the smell of the bilge water was so nauseating that I passed the whole voyage lying in the open on the rice cargo. Later on the horrible liquid, which instantly called up thoughts of diphtheria, was mostly baled out, but much of the odour remained. Fortunate is R. B. in being wholly immune from sea sickness, yet a few minutes of that variety of eau-de-cologne would have given him the same green and yellow complexion as the poor R. A. (Mr. Ramaswamy Ayyangar, Research Assistant of the Madras Fisheries Department) who lay prostrate in the rabbit hutch to the last moment of the voyage.

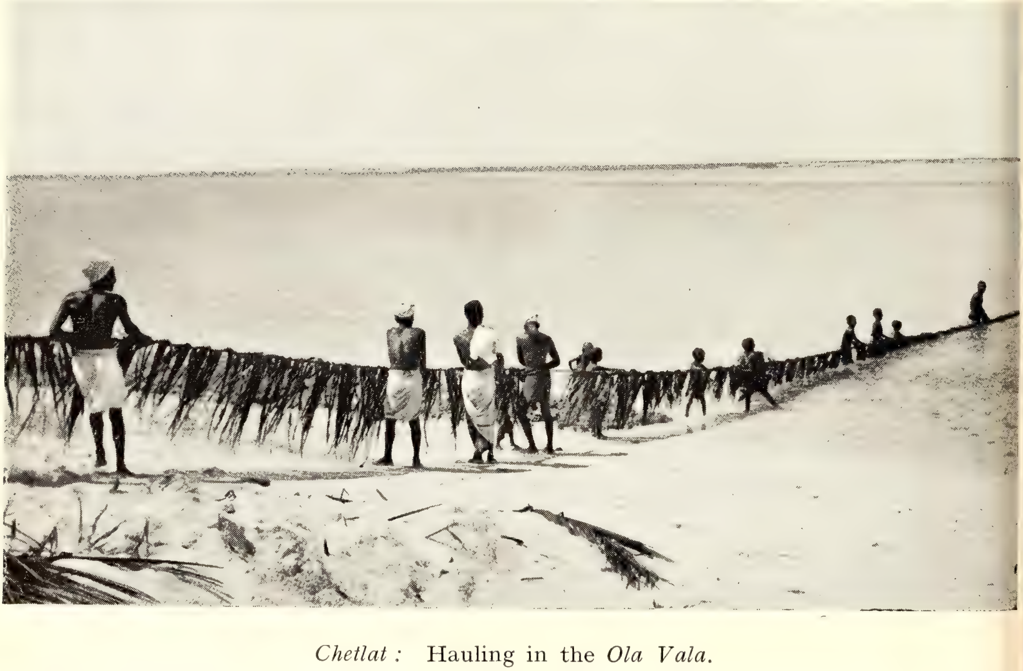
It was interesting to observe the life of the Islanders, Muhammadans all, at such close quarters, and the interest was fully reciprocated! The two cooks, Melacheries by class, the lowest of the four social grades on the islands, prepared curry and rice for all, those on duty having their piled-up portion taken to them on large enamel-iron plates.

During the latter half of the 18th century such craft as this were used on occasion for the movement of troops of the East India Company from port to port along the Malabar Coast; and to this day, as I found on seeing the ship's manifest, it is entered that this small boat can carry 69 natives or 51 Europeans. Such trials did those gallant souls endure who laid the foundations of our Empire in the East.

The Tindal, as the Captain is styled, possessed a sextant in use of which he was wholly ignorant. The course was kept by compass aided by the position of the sun and stars. In the small hours of Sunday morning the sea was rather rough and a rope parted at the masthead. Being roused by the shouts of the Tindal the crew were quickly at their appointed stations and in a few seconds one of the men walked up the mast carrying a rope in his teeth which he rove through the block indifferent to the swaying of the vessel. Soon after dawn another of the crew, very Simian in profile, walked up in the same effortless way and announced 'some country is in sight.' This, after some questioning by the Tindal as to its shape, was announced to be Chetlat. Quite a good shot to hit a one mile bull's-eye at a range of a hundred and fifty! Before long the smudge became a line of verdure seemingly floating in the ocean, then the white line of surf could be seen, and the waving plumes of the palms, and by ten o'clock we were anchored outside the entrance to the lagoon having been afforded some excitement during the last few miles by a school of porpoises. The harpoon carried by every Island boat of whatever size had been immediately ready in the bows, but no opportunity came for a successful shot.

A square of white cloth flown on coming to anchor brought a boat from the lagoon, and in a short time we and all our belongings were aboard the 'Chetlat', being skilfully rowed in true sailor fashion through the lagoon entrance and over the transparent waters of the shallow lagoon to the sound of a far-echoing chanty on the part of the crew of twelve lusty rowers. A number of the inhabitants, headed by the Monegar, were assembled on the sandy shore to greet us, and I was quickly installed in the Cutcherry; R. A. being accommodated in another building close to it. We were fortunate in finding Mr. A. M. Khan at Chetlat on Inspection Duty from his Head Quarters at the island of Ameni thirty miles to the south-east, for at his hands was received much assistance

Chetlat : The tomb of Carpenter Primrose.



Chetlat : Hauling in the *Ola Vala.*

in many ways and a semi-official introduction to the elders of the community.

The 'Chetlat' is a very substantial and well-built boat constructed by the inhabitants of the Island and presented by them to the Government in 1934 for the use of the Monegar for inter-island communication. It is consewn—not a nail in it—and rowed by twelve men.

In the afternoon a visit was made to the tomb of Carpenter Primrose of the '*Vizier*' against the eastern shore. This merchant ship, laden with cotton goods and cutlery, was wrecked on the Cheriapani Reef, sixty miles to the north-west, in June 1853. The crew found their way to Chetlat where they stayed until conveyed to the mainland, and it would seem that Primrose was the only casualty. The memorial slab let into the wall of the tomb which was built, or rebuilt, a few years ago at the instance of old Muhammad Ali, my boatman and *moopan* (headman) of the island, was carved by men of the '*General Simpson,*' a ship which was wrecked in 1863 on the north reef of Chetlat. The vessel sent to salve the ship was itself lost on the reef when approaching the island at night.

In 1865 the '*Lord Brougham*' was wrecked on the Cheriapani Reef and timbers of all these wrecks appear to have been utilized in construction of the island mosques. Since those days there have been no more wrecks as the shipping passes further south through the nine degree channel; but now the new Port of Cochin brings steamers to and from that port within sight of some of the islands.

One of the vivid memories of that first walk on the island was the sight of the hermit crabs (*Cenobitæ*) going about with shells on their backs, into which portable bungalow dwellings they quickly retreated when alarmed to bar the entrance with a horny claw. Housing problem completely solved! The many forms of life seen on the reef within a few minutes was astonishing. Sea slugs (Holothurians *bêche-de-mer*) were lying about seemingly inert, in sheltered places beside the rocks, and R. A. was soon at work collecting specimens, being busily assisted by a number of children attracted to this new form of treasure hunt along the shore, every nook and cranny of which was so wonderful to us and commonplace to them.

We all drank of young coconut milk, the customary hospitality in all countries where the coconut is grown and so, quietly wandering through the shady palm groves with eyes alert to notice all so strange and new, we made our way back to the cutcherry now my home for the ensuing ten days.

Next morning there was an official rat-hunt, part of the Monegar's inspection work in pursuance of the organized methods found necessary to check the increase of these pests (*Mus rattus rufinus*) which have become almost entirely arboreal and do much damage to young coconuts. A few nests were found and destroyed, some half dozen rats killed, among much excitement. The men walked up the trees without rope or other aid of any kind with little apparent effort, and their great muscular development above the waist due to rowing, beating coir-fibre, and climbing the trees for fruit was most noticeable.

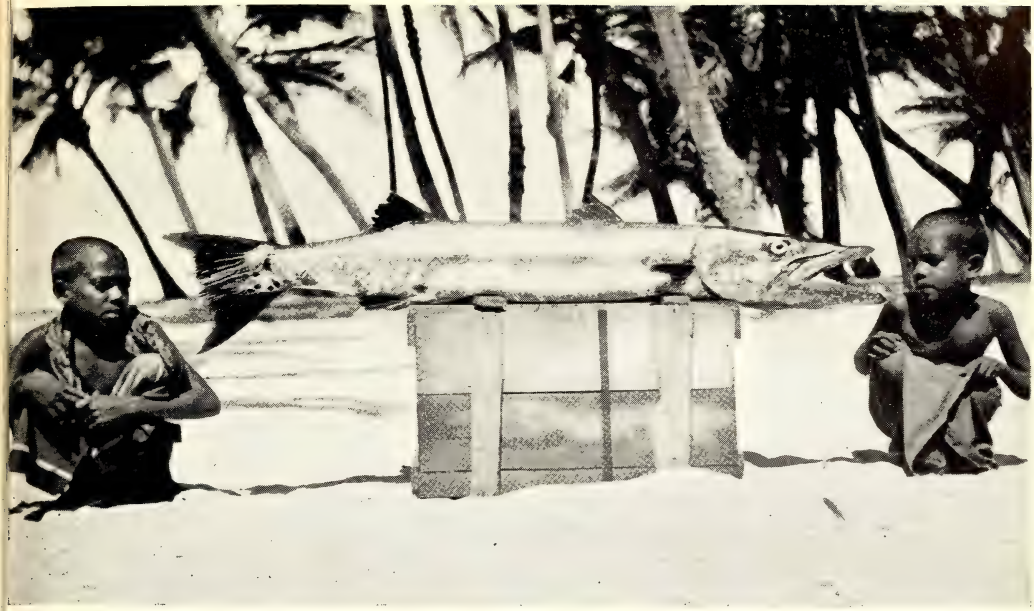
In the evening an entertainment was given by some women and girls. Sitting in a circle they beat time with the palms of their hands the while all sang to the lead of a witty lady of mature years who gave all the topical allusions suitable to the occasion: judging by the hilarious reception of the 'hits' she was highly successful!

The morning after arrival I went to sea in a lagoon boat. Several fish of good size failed to get hooked—all sea fish have very bony mouths, but a fine barracouda (*Sphyraena commersonii*) of 36 lbs. (55 ins. by 22 ins.) was captured on a trolled bait. Of much the same size and shape as a good *seir* fish he did not put up the same fight for freedom as that sporting variety of the tunny. He has a great armament of formidable teeth, as can be seen in the photograph where he is posed with two small boys; the boy at the business end clearly registering alarm! That evening there was another entertainment, but of a religious nature, in which men acted with great fervour. The following day the Monegar was rowed away to Ameni and we settled down to the collection of specimens and to fishing.

Several mornings producing few fish I took to going out from sunset to ten o'clock, and very beautiful it was under the moon and brilliant stars; but even then the sport was by no means up to expectation, the best evening being nine Caranx (*C. nigripinnis*) averaging 11 pounds, all on trolled natural bait. The island fishermen also caught few fish by day or by night on hand lines and during my stay harpooned not more than half a dozen.

One afternoon a *Seir* fish was harpooned close to my boat and it was most interesting to see the preliminary play of the *poemeen* (the crude wooden imitation of a flying fish), the tense attitude of the striker when he became aware that a fish had been lured from the depths, the hurling of the heavy fourteen foot harpoon and the thud as it struck the fish. Instantly the thick coir line is torn out of the boat, the shaft becomes disengaged. Now the man wielding the sculls manages the boat according to requirements and instructions of the harpooner; soon the fish is tired, brought near the boat, skilfully gaffed by the oarsman and lifted in. In such manner do these sporting island people of mid-ocean secure all creatures which swim in those seas—except the whale, which they leave severely alone.

Harpoons are of three kinds. The heavy 11-foot shaft used for porpoises, dolphins, sharks, rays, and the like; the three pronged 14-foot shaft for *seir,* turtles, and such large fish as are not usually struck close to the boat; the twelve pronged 8-foot weapon used for flying fish, *gar,* and other small varieties found at night in the lagoons and along the reefs by aid of palm-leaf flares. The prongs of this latter, which is used in a somewhat similar form by several eastern peoples, are of bamboo or other hard wood sometimes tipped with brass. These are placed concentrically—six on the outer circle and six on the inner, these last being two inches shorter than the outer ones. The shafts of all



Chetlat : A Barracouda : 36 lbs.

Collecting at Chetlat.

are of coconut wood about 1½ inches thick in the middle and tapering to each end.

The fishermen are marvellously adept in the use of these crude but efficient weapons and quite evidently take pride in, and greatly enjoy, the sport which entails a high degree of skill. Distance, pace, refraction, direction, all have to be judged in the split second of the opportunity which may come at any moment. It is at night that the most varied sport can be obtained, the best conditions being when there is neither moon nor wind. The beauty of the scene is almost more than can be imagined; there is the reflecting mirror of the lagoon, the sparks flying from the torch, the dancing sparklets of the rippling water, the bronzed statuesque figure of the poised harpooner, the low-echoing undertones instructing the oarsmen, the thud of the weapon and the resulting jubilations of the crew. What memories all this recalls!

The reefs at any time, and more especially at night, are infested with creatures it is well to avoid: clams, octopi, sea-urchins with poisonous spines, knife-edged pieces of coral await the unwary; so on the frequent occasions when it is necessary to ease the boat over an obstruction there is always the possibility of injury to bare feet: but the fishermen seemed not to mind or take any particular care, while I was usually anticipating some mishap!

Besides harpooning and hand-line fishing beyond the outer reef nets of three sizes are used in the lagoon. The *muluvala* is of small mesh, about fifty feet long by five feet deep, worked from the shore by four men; with it small fish suitable as bait and for the family curry are caught as required. The *muduvala* is a circular casting net for catching small fish, and has no radiating strings as on the mainland nets for these would entangle in the coral. The *kadalivala* is a much larger affair and is used in conjunction with the *olavala*, this being a rope many hundred feet in length on which are tied lengths of palm leaves, the use of it being a holiday occasion.

The method was demonstrated one morning. The palm-leaf affair was loaded in equal parts into two boats which were rowed some four hundred yards from the shore by crews of a dozen men. At the selected spot the ropes were joined—the boats then returning in a semi-circle paying out the rope as they came. At intervals men went overboard to free the leaves from coral obstructions and aid the net by wading with it to scare the fish inwards; and so the boats came to shore with but two men in each of the dozen who had gone out. Now willing hands of boys and men tail on to the ropes and haul in until the semi-circle has been reduced to dimension required for use of the *kadalivala*, which is taken in a boat from one corner and payed out inside the leaf net. Soon this real net hems in all the fish, and quickly the struggling catch is brought to the sandy shore where all stand around watching the rainbow sheen of fish of a dozen curious makes and shapes. There could be no speedy killing of the poor fish for among them were several surgeon fish (*Acanthurus triostegus*) of five to six pounds armed on either side of the waist with bone lancets of razor keenness which have been known to inflict mortal wounds by severing an artery of the incautious handler. When not excited these weapons remain folded and sheathed, points towards the head, but are instantly erected as rigid weapons of offence.

There were several box fish (*Ostracion cubicus*) that curious handiwork of Nature which can move only two fins and tail, the scales being ossified and body square in shape. It is not eaten. Then there were one or two globe fish (*Tetrodon ballistes*) blown out like balloons with fright and having very funny faces: these also inedible. The island urchins have the cruel amusement of tickling these fish to cause them to inflate, then popping them off with a playful jump. The bulk of the fish taken were blue and yellow parrot fish (*Pseudoscarus tetrodon*) with prunes and prism snouts, about five pounds each in weight. In all there was some 150 lbs. of fish.

Along the West Coast opposite Mangalore the hundred fathom line is about 45 miles away and then the ocean depth soon increases to one thousand fathoms and over. The islands are on a chain of peaks rising from the ocean bed 6,000 feet below, but as to the probable geological process which led to these coral atolls being formed it is necessary to refer to the chapters on the subject in Gardiner and elsewhere. Immediately beyond the edges of the fringing reefs soundings give a depth of 5,000 to 6,000 feet and more!

The island of Chetlat is 1 mile 1,150 yards in length by 650 yards in width at the widest point, and contains 255 acres. The November temperature is a humid 78 to 84 degrees. The inhabitants number less than 900, males and females in almost equal proportion. There are 180 occupied houses. Most of the people are Melacheries, the class described as landless tree-climbers. Those who can read the Koran do not climb trees and are called Mukris. There are no dogs, crows, or land snakes; and though commissioned to collect specimens of sea-snakes none were to be found and they were not known to the islanders.

The few birds and butterflies are mostly migratory. The highest part of the island is not more than 15 feet above sea level. The average rainfall is 60 inches, most of which arrives in June, July, and August. The island is not so thickly grown with palms as some of the others; but the quality of coir is said to be superior, probably because it is all soaked in sea water. The palms at the south end of the island are much taller than those elsewhere but I could learn no reason for this.

In *The Blue Lagoon* (H. de Vere Stacpoole) is an account of a fight with an octopus; and finding smaller specimens in pools among the coral I witnessed the creature's methods of attack and the inky discharge by which the whole pool is clouded when it is forced to defend itself. The two-foot tentacles could be detached by one's fingers, but it could be well imagined how helpless one would be in the grasp of a big one, and they are known to grow to an immense size. The islanders use them as food and for fishing bait.

Specimens of the Giant Clam (*Tridacna*), known to grow to a weight of 800 lbs., were a common sight on the reefs, the smooth pearly-white curving lips open and ready for any chance prey which might happen into the vice-like grip, the only release from which would be a severance of the powerful muscle at the base of the shell by which it is closed : for the shells are almost part of the rock on which they are found. My walking stick thrust into the open jaw of quite a small one had to be released by use of a long-bladed knife. Deadly, absolutely, would the grasp of one be to a man caught at low tide, or when diving, for the muscle is of enormous power, nothing short of a crowbar being able to prise open or detach even a small one of ten pounds.

The lagoon is on the western side and about 600 yards in width, extending almost to the length of the island. Owing to the small variation in the tide level, which is less than three feet, the outer reef is but little exposed and it is only on perhaps two days in any one month that paddling exploration of the reef can be made; so on only one day of our ten were we able to thoroughly explore. Then R. A. added numerous treasures to his collection and I witnessed many forms of life never before revealed to my wondering eyes. My camera not being with me on that occasion I was unable to take a picture of a large sea anemone of brilliant colours which lay in shallow water : next day there was a strong breeze and deeper water, so the opportunity did not recur: how true that is of many such ! Bacon has something very apt which will not be inflicted on the reader, and readers of Shakespeare will recollect a very true saying. 'He who will not when he may—', etc.

That first day of exploration on the exposed reef was of absorbing interest. Beneath almost every movable stone or piece of coral is a creature of some kind; a crab; a many-footed creature like a centipede; a brilliant little fish; a mottled eel which would rapidly undulate into a crevice, the entrance to which would be speedily barred by a snake-like head full of sharp teeth; there were also sea-urchins prickly as hedgehogs, sea-stars and star-fish; while amongst the surf of the reef a few feet away might be seen a four-foot shark. In every pool holothurians (sea slugs, *bêche-de-mer*) of several varieties lay apparently lifeless, yet containing within them commensal life in the shape of a small fish (*Fierasfer*) having this strange dwelling for a lodging. This little fish, similar to most fish except that the ventral fins are absent, issues from its host when water is ejected, retreating to safety with a returning stream. It is about as long as one's finger. One small sea anemone I found and examined. It has no bony covering and anchors its foot to a rock. It is a coral, yet secretes no coral, and consumes such life as is suitable to its digestion by sucking it in at the centre of its petal. One of the sea worms found among the coral at low tide was about a foot long with a marvellous set of feathery feelers at its mouth. It progressed like a snake and was sticky to the touch. The men said it was poisonous but, though it looked very unpleasant, it was probably harmless. Another creature impossible to investigate lived in holes in the coral, protruding long whitey-yellow tentacles which, on being touched, were withdrawn with great rapidity : this was also said to be a harmful beast the touch of which would cause the part to swell. Many other strange forms of life were seen, and the only life above the water was a heron so exactly the colour of the background of the rocks on which he was expectantly perched as to be almost invisible. No doubt he was a very expert fisherman.

In the lagoon the expanse of water is an ever-changing picture of great beauty. The colour varies with the depth of the water and the nature of the floor, being pale green where shallow and splashed with darkest sapphire where deep pools lie; while the underlying coral rocks resemble fleeting shadows cast by clouds. Seawards is the fringing-reef beyond which the deep indigo of the ocean shows in the photographs as a line drawn across the picture. Ever is there the unceasing roar of the waves dashing over the reef, for even in the calmest weather there is a considerable surf which increases to high-tossing clouds of spray when white horses are riding at sea. Within is safety in all weathers and then the graceful island boats, fashioned in such marked contrast to the heavy dug-outs of the canoe coast (as the west coast is styled in contrast to the cataraman coast of the east side of India) are busy fishing and tending the bamboo basket traps put out for crabs and lobsters.

Into the lagoon are two entrances from the sea, that to the north being the one used as the other is very shallow. The islands are formed of coral built up from underlying banks of reef-building corals. How the banks came to be there is matter for some difference of opinion, but there must have been some upheaval as is evidenced by the masses of coral conglomerate found along the eastern face of all the island and now undergoing erosion, as can be plainly seen—and felt if you fall about on it as I did!

The fringing reefs are great banks of coral which run out into and under the sea, that on the eastern side being but a hundred yards wide and dipping abruptly into the great depths of the surrounding ocean, while the western reefs shelve some hundreds of yards before they plunge into the 6,000 feet which is the depth not half a mile away. The floor of the reef is visible at a depth of 90 feet, so crystal clear is the water of these seas, and it is along the dark indigo line of the deep ocean where the reef disappears from sight that the best fishing is to be had, for there are the big fish searching for their food. 'The little fish lie in the shallows, the big fish swim without' wholly true of rivers, is also partly true of coral seas.

All over the fringing-reefs can be seen luxuriant coral interspersed with bays of silver sand. Great trees of coral border those shining valleys, while through the water glass can be seen slowly moving fish of varied hues and strange shapes wandering in seemingly aimless fashion in and out of the coral jungle: but all are there for protection or food, and some of them such as parrot fishes and file fishes actually feed upon the coral itself cracking the tubes like a dog cracks a bone and eating the polyps as a dog does marrow. Some of the crabs and other creatures put on a garb so closely resembling coral as to have an almost sure protection from their enemies. Certain species of crabs live at a depth of thirty fathoms which is about the extreme depth where the polyps can build.

Live coral has many very beautiful colours. Rose pink, blue, brilliant yellow, purple tipped stems of many branching forms are seen, apparently waving in the pellucid water when viewed without the water-glass, but only these tips are alive, for the coral stems and trunks are all skeletons of the dead upon which the living coral is raised.

Leaning over the side and gazing through the plate glass screen as the boat moves slowly along everything is as in an aquarium, but on what a vast scale! Marvellously are the processes of nature in its most wonderful form brought before one by such a kaleidoscopic picture. Countless thousands of millions of the tiny builders are at work forming these reefs on which have arisen islands habitable by man. Rising above the surface the coral is broken by waves and thus ground into sand; more and more sand is formed, perhaps a great storm may arise and bring added material from the ocean bed, a bird drops a seed which germinates and more seeds fall, so grass and certain species of shrubs appear and bind the sand together: a coconut is borne from the distant land and so coconut trees take root, and the question may be asked as to whether man planted coconut trees on these islands or was he attracted by the trees already established?

The fish I used for trolling-baits out at sea were of various colours. The most useful seemed to be the goat-fish (*Unpenoides*) so named on account of the beard-like feelers depending from the chin. These were cream colour with longitudinal yellow stripes. When the eel-like mackerel-coloured half-beaks (*Hemiramphus*) were used at night they were very successful; and a dark green jew-fish did good work in luring a fine red perch (*Lutjanus*) of 13 lbs. A few sharks were caught, 30 lbs. the largest, but nine of the fish caught at Chetlat were horse mackerel (*Caranx nigripeinnis*). It was very disappointing not to get better fishing when so much was expected; the fishing on the Malabar coast had been better: there 29 fish of 547 lbs., here 15 of 172 lbs.

The mornings and evenings were spent in wandering about the island looking for butterflies, insects, birds, shells, and just for the pleasure of seeing the people at work and how they lived. Only five species of butterfly were captured, all with the appearance of having been blown over from the mainland. Two kinds of bees sought nectar from the blossoms of a hardy shrub, a gecko fell from the palm-thatched roof of the cutcherry, and an occasional skink scuttled among the leaves. Dragonflies were numerous and difficult to catch; numerous crickets and grasshoppers afforded food in plenty for the several blue Rollers (*Coracias benghalensis,* Ceylon and South Indian race) which hawked among the palms.

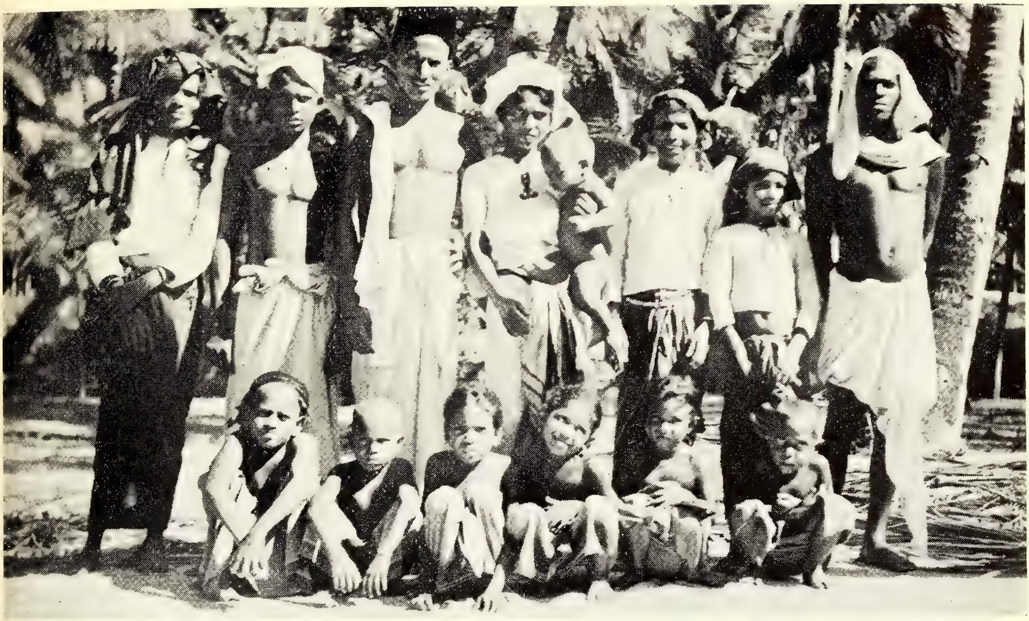
Of birds of prey the only two observed were the Pale Harrier (*Circus macrurus*) and Montagu's Harrier (*C. cineraceus*). Some small birds flitting among the dense foliage of the trees could not be identified, and I had no gun. There were no gulls.

The drinking water of the island is found by digging, the excavations being steened with coral stone. These places, as also the several bathing tanks made in a similar way, are very badly cared for and a cholera epidemic would take very heavy toll of life. The water had a very uninviting appearance and I saw to it that all for my camp was carefully boiled, a kerosine tin at a time. In the bathing tanks were some fresh water minnows which helped to keep down mosquitos, unpleasantly prevalent but fortunately not malaria carrying as are those on the island of Minicoy, the most southerly of the Laccadive group.

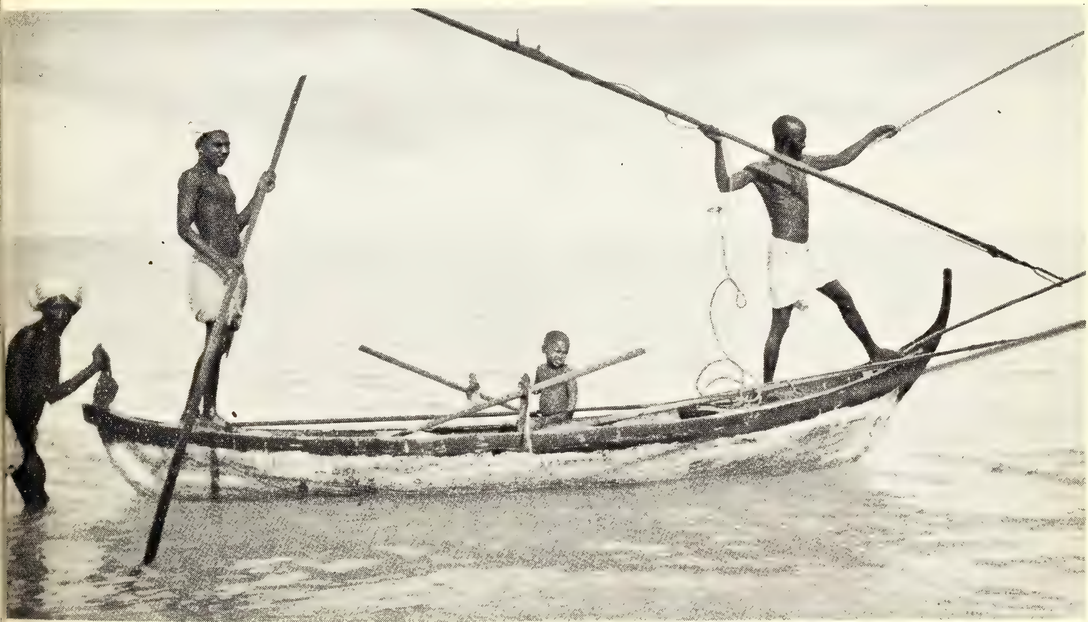
The people had few domestic animals. There were two or three cows and a few goats, so milk was known to but few of the children. Fowls were kept by a few of the more enterprising and eggs were offered for sale, but I did not encourage sale to my camp of any provisions as there was little that this isolated community could spare. There being no shops money was not much in demand. The children were insatiable for biscuits of which a ship-load would not have sufficed, for the grown-ups wanted them as well. My own fare was simple, as always when out in camp. Dal, rice, *atta,* potatoes, onions, sugar, jam, tea, butter, and the usual condiments met all requirements: it had not been difficult to arrange the forty days supply for self and servants.

On the whole the people looked undernourished and suffered a good deal from eye troubles which, it was gathered later from a medical scientist, may be due to some deficiency in diet. Leaves of the horse-radish tree (*Moringa pterigosperma*) appeared to be the only vegetable eaten. Old and young alike were affected with skin diseases. The staple food of the islanders is rice all of which is imported from the mainland in exchange for coir rope at a price fixed by Government. No coir, no rice, so all families have to be pretty constantly at work husking the coconuts, burying the fibre on the shore in prepared pits where it is covered with coral stones for about six months, uncovering these pits, beating out the fibre on blocks of wood with wooden mallets, teasing the fibre to make it ready for twisting, and making it into rope. Then it is packed into bundles of a specified weight and size, weighed into the island store room by the clerk-in-charge, and rice given in exchange. Certain stages of the work are done by women and children—quite small girls and boys taking their share, and at most hours of the day before noon the sound of the beating mallets can be heard almost as insistent to the ear as the coppersmith in India.

The meat of the coconut, the copra of commerce, is used as food—coconut rice cakes are very palatable—and the balance sold by the islanders under their own arrangements. Beyond what they get for these products of the coconut tree, and the fish they catch, they have no other principal means of subsistence. Nothing do they grow, or can they grow, in the sandy soil; yet lantana and



Chetlat : Laccadive Islanders.



My Fishing Boat.

the aloe plant, if permitted to flourish, would soon overwhelm the little open space that exists.

The clothing of the women is much the same as worn by a similar class upon the mainland. Ordinarily the male population wears little but a loin cloth, a costume almost necessitated by the climate for any active work. Some of the men are of very fine physique, an instance being a hairy-chested fellow, one of my boatmen. I met him one night when out fish spearing and he presented a flying fish to me, one of the few seen during the whole trip. As the flying fish is much hunted by all the large predaceous fish of these seas—sword fish, bonito, and the like—their absence was a bad sign.

The life of the people is very well ordered and ruled by a simple penal code, but of crime there is little and that mostly the theft of one another's coconuts! There is certain work, such as the launching of the larger boats or the hauling up of one into a boat shed, which is a communal duty. For this, and for the daily coir and rice transaction, the people are called by a peculiar cry started from the required place of assembly and repeated from house to house. It closely resembles the howling of jackals! The boat sheds are of coconut beams and rafters thatched with palm leaves, these roofs abutting upon uprights of coral stone. The eaves are close to the ground so that the boats are well protected from the monsoon storms. The dwelling houses are of similar but neater construction and well fitted for the climate. All face north, and the walls are of coral stone quarried by much labour from various places on the island.

The Laccadive islands are sometimes visited by destructive cyclones, and evidence of these great storms is to be seen on the Eastern side of most of the islands. Great masses of coral are torn up from the ocean bed and piled to a height of many feet, where they act as rugged breakwaters. Such storms must have devastated Chetlat on several occasions. On the 15th April 1847 several of the islands were almost denuded of coconut trees, many hundreds of the inhabitants perished, and many houses were destroyed. The islands of Kalpeni, Androth, and Kiltan—the latter only 30 miles from Chetlat—were devastated, so perhaps it was that storm which piled up on the north-eastern reef of the island the great masses of coral. Since those days the population of all the islands has greatly increased: in 1795 there were but one hundred inhabitants on Chetlat, and Kardamat was uninhabited. Such storms on these mid-ocean islands are terrible visitations; coconut trees are blown about like feathers to the accompaniment of a deadly hail of coconuts.

A feeling of expectation, of something likely to happen, always accompanied the exit through the lagoon channel with the roar of the surf on either side and the sight of the swiftly moving mosaic floor of the reef crystal clear below the boat. Soon, when the rod was set and the bait trailed thirty yards behind, one had leisure to sit in quiet contemplation and enjoyment of the hour as the sun began to sink behind the great bank of clouds which arose every evening on the Western horizon. On the one hand the foaming surf of the reef backed by the feathery palms on the further shore of the beautiful lagoon; all around the quickly changing hues of the water now looking cool and peaceful where but an hour ago it was glittering under a fierce sun; and along the horizon the enormous clouds formed massive purple battlements, castles in the air, the illusion of snow-topped mountains, static too, as if real and not unstable, so slowly did they change their shape: then the silver changed to gold as the sinking sun shot great rays to the zenith and the dying day rapidly gave way to the wonder of the tropic night.

This was the hour when one might expect to have the line torn off the reel with all the resultant excitement and expectation. Is it a *seir*, or a caranx, or perhaps a shark? One soon got to know the manner and feel of the various species. Some, like the red perch, would at once make for the floor and a coral retreat from which dislodgement would be difficult, so whenever the bait was seized it was well to allow as little liberty as possible: in anticipation of such happenings tackle has to be strong. A few good fish were lost for one reason and another but the sport was not up to what had been hoped for; it might have been better six weeks later, and should another trip be made to these seas it would be during December and January to a locality ascertained shortly before return to the mainland some weeks later. There would be sword fish, seer, bonito, perch, caranx, and other sporting fish in great variety.

At night the sea was highly phosphorescent. At each movement of the oars globules of light floated away, brilliant patches of jelly fish and other forms of marine life went past, and on several occasions large patches of phosphorescent light floated from below to remain a minute and then fade away; what this was the men could not explain and it never occurred close enough to be investigated.

I used to let the men put out a hand-line and keep themselves amused by singing chanties as we rowed along. Noise seemed rather to attract fish than otherwise; and when we occasionally hauled in the lines to light palm-leaf flares in order to try and harpoon a *seir* fish it was often that the trailing bait would be taken immediately after within a few feet of the boat. Sometimes we would get close to another boat and then the picture silhouetted in the night by the spark-throwing torch would be of a very striking description. On a future trip an automatic camera flashlight apparatus must form part of the equipment.

When a hooked fish was reeled in to be gaffed great lines and flares of phosphorescence were set up far below by its wild gyrations and all eyes would be out of the boat to judge of the size. Many were the laughing comments on the lengthy business of playing with the rod a fish which would have been summarily hauled in by themselves using a hand line, and jerked into the boat. Old Muhammad Ali used to be doubled up with laughter at the idea; and when one evening the butterfly net with a small receptacle at the end of it was skimmed along the surface of the water as the boat moved quietly under the full moon for the purpose of collecting plankton for scientific examination, he and the crew, thinking this to be another method of the mad *Feringhi* for catching fish, laughed so that tears streamed and the merriment ceased only when the scream of the reel afforded other excitement. All that I had was strange. None of them had ever before seen a fishing reel. Said old Ali with much emphasis, 'More than seventy years have I lived, and never have I seen such a *tamasha* as this!'

It was old Muhammad Ali, headman of Chetlat, who hired to me for the remainder of the trip the use of his boat with crew of eight men and himself as Tindal, and a very excellent crew and craft it was. He was then blind in the right eye but now, alas! has lost the sight of the other from the same cause, that very common trouble among eastern people in particular—cataract. Never again will he see the foaming surf of the reefs, the marvellous sunsets, the tremendous majesty of the monsoon seas and storms known to him since childhood: but I hope again at some future time to take him out fishing and let him have the feel of a good fish on my rod.

The 'Valia Bukkari,' in which we had sailed from the mainland in 54 hours, is slightly larger than the 'Poo Odam' which is of 15 tons burthen.

All night we sailed quietly along in the 'Poo Odam'—the Flower Ship—to wake at dawn after hours of peaceful slumber in that warm air and look over the immensity of the grey of the sea shot with soft hues; there was a brief pause, then with a smile the day broke to reveal the palm trees of Bitra Par seemingly floating in the water at the northern end of a great lagoon seven miles long by three wide encircled by a ring of creamy breakers.

The main entrance is at the southern end, and there is a possible way in over the reef close to the east of the island of which I had no knowledge or would have urged we make for it; but before I realized what was being done we were inside the lagoon through a small high-tide gap known to the old man, and mighty proud he was to have found his way in! But pride has a fall, and he wasn't so perky when the wind failed entirely, for it took within half an hour of dark to kedge the boat to our destination; and the crew were wholly fed up with 18 kedges of 20 minutes each, besides rowing R. A. three miles to the island to shorten the miseries of a bad sailor, for the boat rolled much in the calm lagoon. That night I again slept on my six-by-two piece of deck, lulled by the unceasing surge of the sea on the reef, after having caught with a hand-line a 15 lb. *kaduva* (caranx) and a red perch, both of them very pale in colouring, the result of habitat on the sandy floor of the lagoon.

Next morning tents and everything else required was landed and camp pitched among the palms. Bitra is uninhabited, except for one family from Chetlat which lives there during the fair weather months to look after the coconut trees and make sugar from the palm juice. In one of the pictures the man is seen walking up one of the trees near my tent to take away in a bamboo bucket the juice which has collected during the night in the small coconut gourd placed the previous evening beneath a cut made to receive it. The palm juice has to be collected in the early morning as these Muhammadan people may not drink the potent spirit which can be made from the fermented liquid. The trees belong to Chetlat, but all the islands have equal fishing rights, so I was not surprised when the caretaker complained that a fishing party from one of the distant isles had raided all the coconuts.

This man had pigeon-toed, widely splayed feet well adapted for the climbing of coconut trees—which is done without extraneous aid of any description. I saw some similar feet at Chetlat, and it is likely that the palm-climbing done from early youth causes this adaptation which, were it not that the women never climb trees, would probably become an inherited characteristic. All the men of the crew could walk to the mast head in just the same effortless manner.

The family occupied a house, on the eastern side of the island, of the usual coral-stone palm-thatched type with a well close by. They lived in the utmost squalor, in the dirtiest state imaginable as to surroundings, and the well was full of leaves and debris. At the south-east corner of the island is an excavation about two feet square containing somewhat brackish water. This was at once cleaned out for use of my camp and we soon got used to the taste of it; but I liked it best, or disliked it least, made into tea. During the monsoon months both these supplies are too salty for use, and until the island has much increased in size—it is now but 28 acres—it will be likely to remain uninhabitable on this account.

The night was cool and there were no mosquitoes; rats and crabs did not trouble me, but my servant said they tried to penetrate his curtains and share his bed! I had feared the mosquitoes and sandflies might be troublesome as much of the island is covered with an evergreen bush (*Scaevola Koenigii*), called *kanni* by the natives, which grows in clumps like a rhododendron. There was also much of a coarse tussocky grass, two kinds of convolvulus—white on the bushes, purple where it spread over the sand—and a few other grasses. The island is 200 yards wide at the broadest part and 1,100 yards long. There is evidence along the eastern shore of some great storm having torn large blocks of coral from far below, as is seen on Chetlat to a greater extent. The coconut palms on this island were definitely not sea-borne but planted by the islanders.

As at Chetlat, so here, we had only part of two days on which the tide permitted exploration of the fringing reef; then a large area was uncovered to the north-west and many treasures gathered by R. A., assisted by the boatmen and my servant Rangaswamy who had become an ardent collector of shells. Nothing very rare in shells was found. There were many large *Pterocera chiragra* and *P. lambis* (*Trochus*) from which pearl buttons are cut and the flesh of which, as also of the octopus (vern: *appalu*) found in plenty on the reefs, is eaten by the people: this latter has a pleasant shrimpy taste and the tentacles are used for baiting hooks.

A good specimen of *Mitra episcopalis* was found in the sand at the south end of the lagoon, but on the whole the shells were rather disappointing as the islanders have taken to collecting for sale in the Mangalore and Calicut bazaars. A heart-shaped sea-urchin, with shape of a star fish impressed on the carapace as by a wax seal, was an interesting find; as also a composite coral shell, a *cirripod* of the crab family of which relationship one would never have suspected it.

It seemed apparent that the south end of the lagoon is filling up, as a considerable area is exposed at ordinary tide, and a fair sized bank about fifteen feet high is always above sea level. On this were a number of sea gulls, some terns, and a few migratory waders. Less than a hundred years ago sea birds bred in great number on Bitra itself but owing to persecution have long since ceased to frequent the island for any purpose. Rats (*Mus rattus rufinus*) are the only mammals; and the only birds seen were a water rail, unidentified, which crept among the bushes close to the tent, a blue roller (Ceylon race), and a Montagu's Harrier. Shore birds began to arrive soon after we did, so before we left I had seen whimbrel, golden plover, avocets, stints, herons and a large black and white stork. The only butterfly seen was a very tired specimen of *Melanitis ismene* which settled at the very door of my tent after the whole island had been searched for several days. Dragonflies were numerous.

A large turtle (vern: *miragam*) came out of the sea one night and laid a great store of eggs which the men soon dug out of the sand. Had they secured the turtle it would have been quickly boiled down for oil with which to preserve the woodwork of their boats; and a horrible smell there is when this operation is in hand. The large net (*ola-vala*), brought from Chetlat for the purpose, was dragged in the lagoon with much the same result as before, the bulk of the catch being jew fish (*Pseudoscarus dussumieri*) most of them about 11 lbs. in weight. There was also a curious fish with large luminous eyes, a near relative of the cuttle-fish, and some surgeon-fish (*Acanthurus triostegus*). All these, except the inedible box-fish (*Ostracion*) and some spiny globe-fish, were cleaned, split, and dried in the sun on sticks placed between poles stuck in the sand. This was also done with the fish I caught outside the reef, so soon the whole place reeked of the oil-exuding flesh covered with blue-bottle flies, and it was a marvel to me how it ever became fit for consumption. As at Chetlat we found no sea-snakes which are apparently absent from these seas though so numerous close to the West Coast.

The fishing was a little better than at Chetlat, but not much. There, 15 fish weighing 171 lbs.: here, 37 fish of 426 lbs. which was far below expectation, as to size at any rate. *Seir* (*Cybium commersonii*, vern: *ayakura*), were seen once or twice leaping high out of the water in furious pursuit of shoals of small fish, but only one was taken, and that with the harpoon. The largest fish was a 90 lb. shark (*Carcharius*, vern: *sravu*) in which were four young ones 22 inches long. Another shark which may have been about the same size got off after a long fight, the hook coming away for no apparent reason. Most of the fish were *Caranx* (*C. nigripinnis*) of two varieties; one, (vern: *molayam*) having a larger eye than the other called *kannam*. They averaged 11 lbs., the largest being 19 lbs. The red perch were *Lutjanus sp.* and a lovely green perch (*Lethrinus*) of 5 lbs. Even with the aid of Dr. Day's well-known work on fishes we did not find it easy to make correct identifications of the 47 specimens collected at the two islands.

All my fishing was by trolling any species of small fish netted in the lagoon or along the reefs, and most of it after dark. It seemed better to so mount the bait on a single hook as to prevent any spin: this I also found when fishing on the West Coast of India. One day the rod gathered a fair harvest of fish. There were two sharks of 40 and 22 lbs., two *Caranx* of 21 and 7 lbs., one gar-pike and two red perch, one purple *ballistes* (*Erythrodon*), and three small perch taken by hand line from a great depth, their eyes popping out in surprise at such an adventure! These were *Serranus mineatus*. The method of sinking a baited hook was to hitch a coral stone on to it by means of a narrow strip of palm fibre; when at required depth a sharp jerk released the stone.

The Research Assistant was indefatigable at his work. The opening up of all fish taken was always done for examination as to parasites and, almost without exception all were infested with one kind or another, the harpooned *seir* fish contained a parasite as big as a thrush's egg—named *Trematode*. It quite put me off eating fish, to know they harboured such creatures.

With the new moon of the 26th November R. A. had certain ceremonies to perform and my boat people commenced the Ramzan, the Muhammadan month of feast, by having a day of rest from seeing me catch fish; but after that they claimed the permitted dispensation for travellers so far as abstention from water is concerned.

I always let the men have a hand-line out when I was trolling, and old Ali used to like pulling the line off the reel to get out the usual thirty yards and occasionally feel the pull of the bait. Several times he had the thrill of a taking fish and the feel of a fish on a rod the like of which he had never seen in all the long years of his life. The reel was a great source of interest.

Several of the men had inflamed eyes and were greatly pleased with the cardboard shades I made for them, so much so that they wore them at night when out at sea!

One day there was great excitement when we were returning to camp across the lagoon. The men suddenly pulled at racing speed; then one of them dived overboard to come spluttering up and ask for one of my large hooks on a hand-line; down he dived again and away tore the line with a big fish at the end of it! Soon the fish was hauled alongside and lifted in with the gaff: 36 lbs. *Chilenus undulatus*, called by the men *chandni ba-la-la*. 'A most noble jew fish' as Tom Cringle said to Mr. Wagtail.

This peculiar method of fish catching was explained to me. The fish is seen in the clear water to swim away and its habit of taking refuge in a clump of coral is known, also that it is so frightened that it will stick its head into a crevice and not attempt to swim off when a man dives after it. The first dive locates it, the second time the bend of the hook is pushed gently along the side of the gills until the corner of the fleshy mouth is reached, when an inward motion with a quick pull sends the point in and the fish is hooked! One day we went to the south end of the lagoon and three more of nearly the same size were secured in a similar way. They have protuberant lips like those of mahsīr and a single row of teeth, the dog-like canines projecting at a forward angle. The tail is broad, there are curious fleshy ridges along the dorsal and ventral fins, and on the shoulder is a hump reminiscent of that on Indian cattle: on the blue scales and gill-plates are rusty-red linoleum-like patterns.

The dazzling white of the coral sands necessitates glare glasses when the sun is out, and when it is not out. During the hours of glare and heat there is not much life to be seen, but as the evening closes in the hidden population of the sands issues forth. Where the sand was before smooth, or perhaps rippled by the ebbing tide, hundreds of crabs emerge from their burrows to seek food and scuttle about in all directions, nipping the bare toes if one stands still for but a moment, and difficult to avoid treading upon if walking quickly. They are of several species varying from yellow to olive-green or grey; and many are really beautiful in the patterned designs upon their bodies. Some have periscopic eyes (*Ocypode ceratopthalma*), eyes on stalks which they lay backwards when crouching for concealment and raise to find out if all is clear for a forward movement. There is nothing new under the sun! If pursued they run into the water where they crouch in imagined concealment and are easily caught between finger and thumb.

Besides the crabs there are other concealed creatures. Sand shell-binders form long casts which are very difficult to extract unbroken, and even more difficult to keep undamaged for museum purposes. And then there are the *Sabellae* which live in colonies and can be seen at low-tide like a number of tubes; when covered by the incoming tide a beautiful fringe composed of the gills comes out like a plume of feathers. One knows that behind all one sees is a purpose and a plan, but how to arrive at the truth? Marvellous are those scientists who have unravelled so many of the secrets of Nature.

The magnificent lagoon of over twenty square miles in extent is an immense tropical aquarium in which can be seen, as we move quietly along in the boat, every kind of coral and fish of many brilliant hues and strange appearance. Football stockings! School Blazers! Anything of that kind. So unused are they to any alarm that one can watch them unobserved. No doubt there are voracious enemies in the seeming paradise—indeed I often saw great splashes of feeding fish amongst the partly submerged clumps of coral against the reefs—but out in the lagoon all appeared peaceful in those pellucid gardens. Here is a place where scientists could spend four or five months in Nature's

Wonderland in perfect security as to climate and weather, and at a small expenditure.

Those marvellous corals! The coral polyps cannot live above the surface, so when the structures reach just beyond the ordinary action of waves they die. It is only the upper part that is alive, so the living part of the reef and the clumps of coral in the lagoon may be only a few inches thick, and all below that level dead as ancient rock. Growing after the manner of trees budding and branching the appearance of the coral seen below the surface—or with the water-glass in the deep transparent water over the reefs, is aptly likened to a forest of trees.

There are many varieties of coral and all are not of this branching description. There are star corals and brain corals, mushroom and fungoid corals, to mention only a few, which are not reef-building and can be picked up in both dead and living state as one paddles about, many of them showing wonderful geometrical designs most fascinating to study under a magnifying glass. The growing tips of the branching corals are rose-pink, brilliant yellow, delicate blue-green of many hues, creamy white, purple, and even black; and when the reef is exposed at low tide the staghorn coral jutting in large patches above the surface has the appearance of gorse upon a common.

Some pieces of red coral we found, *tubipora*, of which the live growth has not been discovered on the Laccadives. It is known on the east coast of Africa, and perhaps grows at a great depth, for some of the reef-building corals work at as much as thirty fathoms, and fragments may have been torn from the ocean bed at time of great storms. It is not plentiful.

All too soon our allotted time came to an end; the ten days' rice was finished; we were overdue to arrive at Kadamat island away to the south-east; so on the afternoon of the 2nd December we anchored outside to await the breeze which would arrive soon after dark. For the last time I gazed over the placid waters of the vast lagoon.

All through the starlit night of the 2nd December we sailed over calm seas from Bitra and at dawn next day sighted the five mile line of palm trees denoting Kadamat, while a few miles to the south could be seen Ameni, the principal island of the Northern Group of the Laccadive Archipelago.

Soon after daybreak the night breeze died away and it was but slow progress we made, the tedium being diverted by the sight of a school of dolphins for which the harpoon was quickly made ready; but we were not so successful as the men of Barlow's ship in 1661, '. . . . , and one day there came two dolphins about our ship and in the evening one of our men struck one of them with a "fisgige" ', and he draws for the reader quite a good picture of a dolphin and a flying fish 'on which the dolphin doth prey for his food many times.'

Drawing nearer to the north end of the lagoon we were within hail of a one-man fishing boat which came to us for exchange of news. He had a flying fish trailing behind on a stout white cotton hand-line in hopes of sword fish or *seir*. No doubt he did not wish that a dolphin should take his bait, for it would be more than one man's work to hold and harpoon one of those vigorous creatures: ' . . . . and not long after we took a fish with a hook and line which weighed about sixty pound, which had a long snout or bill, of two feet long, which we ate, he being very good meet,' that would have pleased him better!

At last, we made the entrance of the lagoon, and slowly gliding in sailed and poled along for two and a half miles a few yards from the edge of the sandy shore, accompanied by some of the people curious to see the white man whose visit to their island they had long anticipated. Opposite the centre of the island we came to anchor, to land amidst a concourse of the inhabitants headed by the Muhammadan Hospital Assistant who had come across from Ameni on inspection duty. Soon we gathered the local news—a rice boat had just arrived from Mangalore and there were letters for me; a *seir* fish was harpooned yesterday; a big sword fish was speared last week; bonito had not been seen for some time; the Mónegar at Ameni wishes to have early news of my arrival.

Soon we were comfortably housed, I in the Cutchery—the Court House of the Magistrate, the Research Assistant in the School building now closed for the Muharram. Now that we had arrived at this populous island of 900 inhabitants my crew had to strictly observe the fast of Ramzan so could not be reasonably asked to spend long hot hours out to sea: a mental note was made that a visit to the islands should not coincide with any religious feast or fast.

The first day, however, I went out fishing, and was fortunate in witnessing an unusual affair which is probably seldom seen by white people. In the early morning we rowed across the shallow two-mile width of the lagoon to cross the reef at high tide; then, letting out thirty yards of line from the reel, two caranx of the same large-eyed species taken at Bitra were caught on the small yellow-striped goat-fish (*Chilenus sp.*) which was the bait most commonly obtained here. We failed by twenty feet to cut off a porpoise undulating on the surface—the harpoon was not ready. How often does the sportsman, or the photographer, miss opportunity from not being ready! Then a turtle, too carelessly stalked, dived as the boat approached, and a second attempt also failed.

Now came the commencement of a memorable hunt. A long way off some men were playing the *poemeen*—the dummy flying fish—to entice *seir* from the depths beyond the edge of the shelving reef, and from them came loud shouts the purport of which, understood by my men, caused great excitement. Racing to the scene we found a school of porpoise rolling about bewildered by the noise of several boats endeavouring to encircle them. I thought they would be harpooned, but that was not the game. Soon other boats came up, and with fourteen boats joining in the hunt the shoal was hemmed in towards the reef and herded in the direction of the main entrance. There was a great shouting and banging of oars on the water and thumping of thole-pins amid great excitement. At this time I took a photo of the men, and again of the poor porpoises confused and not knowing where to go.

Now the shoal is in the entrance channel to the lagoon, the boats close in, the shoal is cut off and forced towards the shallow water near the shore. Now from each boat leaps a man with ready knife, rapidly each poor helpless wallowing beast is slashed behind the head, stabbed in the side, and in a few minutes the beautiful light green water of the lagoon is crimson beneath the blazing sun. All this is done with exulting shouts amid great excitement, and now the men stand around, hand on hips, watching the poor stricken inoffensive creatures pumping out their heart's blood while threshing round and round on the coral stones in their death agony. In the photographs the result of this is written on the hides. One, badly wounded, escaped over the reef to the sea, but being quickly pursued by seven boats was harpooned and towed back to lie with the others.

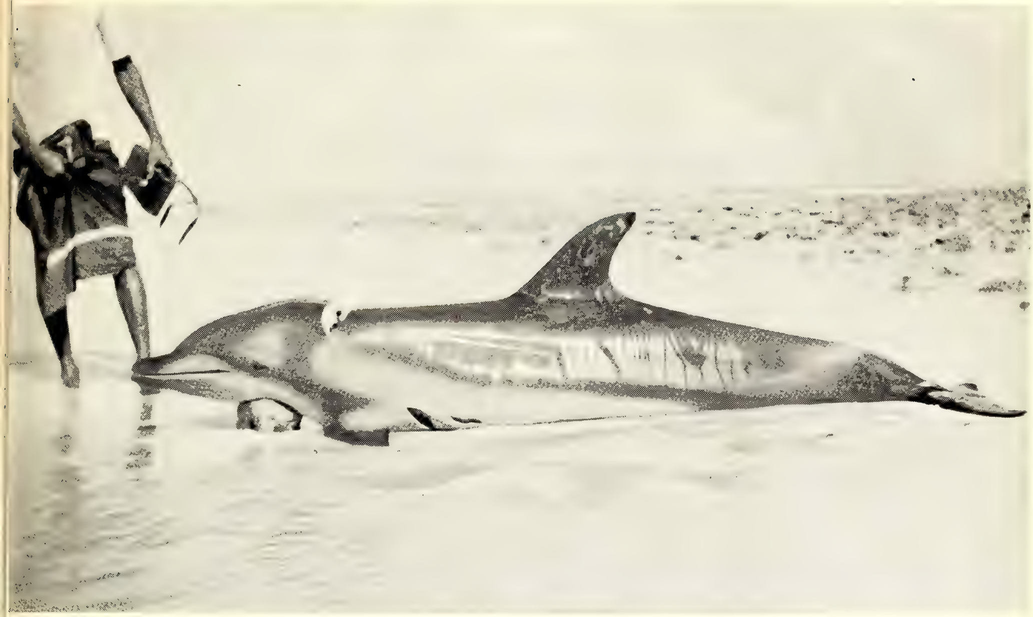
Eleven had been killed, ten porpoises, of which one was a young one of about 200 lbs., and one dolphin. I estimated that not less than 6,000 lbs. of meat had been secured within five minutes! No wonder the men had been so excited, for it would seem that it is not often the porpoises are found in such a favourable situation for a drive. The last occasion was said to have been five years previously.

As soon as the turmoil had calmed down there were whisperings and glances in my direction and I at once saw what was afoot. Backshish! From me! Why? I told them, by signs not to be misunderstood, 'nothing doing!' For why should I, as good a shouter and banger as any of them with my crew of six men, why should I pay? And just then one of the men trod on a sole concealed in the sand so there was other distraction, and the fish being soon captured I claimed it for my breakfast. 'My backshish', said I, and they all laughed.

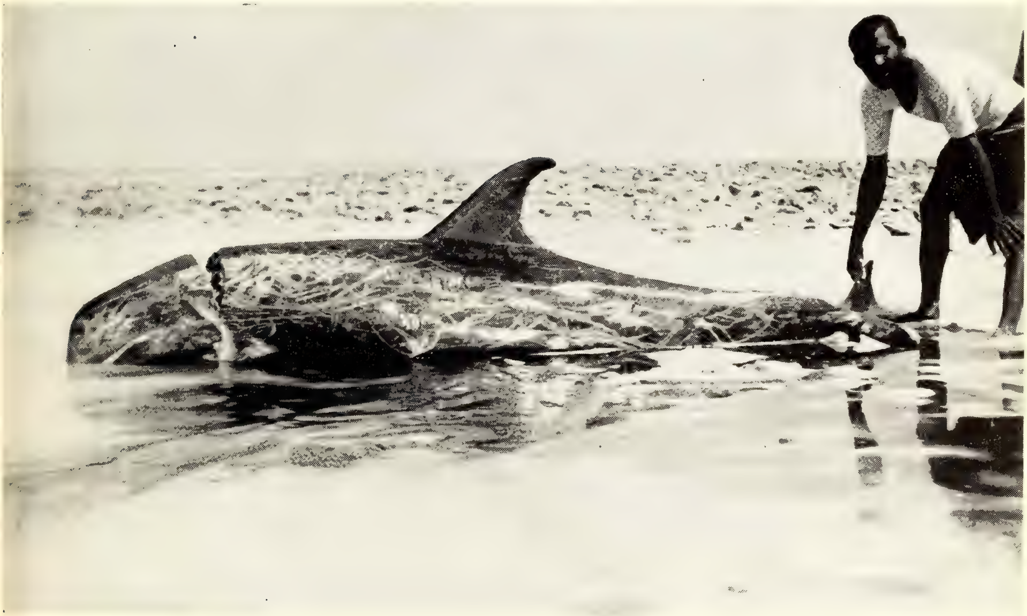
The porpoises were common porpoises (*Phocaena phocaena*), and the dolphin the common dolphin (*Delphinus delphis*), a cetacean, or marine mammal. It is strange that this latter should have been with the porpoises. Perhaps, like the famous New Zealand 'Pelorus Jack', he preferred to live a lonely life or have the company of cousins rather than nearer relatives. There are nine species of cetacean in the Arabian Sea.

That afternoon the whole island was festooned with strips of the dark-red flesh, so the people had a great feast after sunset, renewed in the early hours of the morning in anticipation of the long day of abstention from food and drink. It had been a most blood-thirsty sight to witness, and strange to see these men now Muhammadans, but many of them markedly Hindu in appearance, savagely frenzied in the murder they did. In 1795 this island was uninhabited and it is probable it was peopled by converts made in the time of Tippoo Sultan of Mysore.

Leaving the people to the division of their spoil I walked quietly back to camp along a winding path beneath the shady palms. It was pleasing to see knee-high grass and a few quietly grazing tethered cows and to note that the people of this island are



Kadamat : A slaughtered Dolphin.



Kadamat : One of the ten Porpoises.

obviously better off and better nourished than those of Chetlat. The houses are of the same description—coral-stone walls, beams and rafters of coconut wood, palm leaf thatch—each in its own compound, as on the mainland.

The palm-trees appeared more flourishing; and besides the trees common to other islands there are other mainland varieties, mango, tamarind, pipal, banyan, casuarina, but only quite a few which appear to have sprung up accidentally. Several coral sand-stone quarries were seen in use. This stone is of a beautiful whiteness when hewn and fairly soft, becoming hard when exposed to the air. Along the lagoon shore are some thickets of the sweet-scented palm (*Pandanus odoratissimus*) so well-known among the backwaters of Travancore, and within the roomy boat-sheds were interesting specimens of island shipbuilding both complete and on the stocks. I saw very few butterflies.

There are not many who can recollect the great Krakatoa Eruption which occurred on the 27th May 1883 in the Sunda Straits. I have a clear remembrance of the impression made on my mind at school in England when news of it was received. The noise was heard over a radius of two thousand miles. A friend of mine, then on a plantation in Ceylon, thought guns were being fired at Trincomalee. Ashes obscured the sun over an area of a thousand miles and dust fell as far as South America. Pumice-stone, which occasions this mention of the catastrophe, drifted far and wide over the seas and much of it used to be picked up on Laccadive Island shores. I found some on Kadamat, but most of it has disappeared.

In the evening I went out fishing, while R. A. wandered about on the eastern reefs with an attendant gang of urchins in search of specimens of every description.

Sailing down the lagoon close to the shore it was noticed at one point how the coral conglomerate on which the land has been formed is being worn away like a breakwater merely by the gentle lapping of the lagoon wavelets. There are few houses to be seen as they are built inland among the palms for shelter from the great storms of the monsoons which attack them from the east and west. The island ends in a sandspit on which were a number of gulls, also some migratory shore-birds and whimbrel. The exit over the reef is by a somewhat difficult channel and outside we found a number of boats from Ameni on the same quest as ourselves, so it is evident this is a well-known fishing ground. Ameni is about five miles away, with a deep channel between; and though so near, the islands can have no inter-communication during the south-west monsoon.

It was nearly dark by the time we were ready to fish, and very soon old Ali hooked a big one. He wasn't ready, also his line not well coiled, so there was a check, and he received two deep cuts on his little finger while the thick cotton hand-line broke near the trace of annealed brass wire: so away went the fish with one of my best hooks. In all countries fishermen have their own fancies as to gear. In these Islands all nets and lines must be of white cotton—because of the clear waters and white sand say the people—but very conspicuous to my mind. In my experience a *black* line is less noticed by fish than any other colour.

There were not many fish about. A 12 lb. perch afforded good play, and the men caught a few small gar-pike, using sections of octopus tentacles as bait. Other boats were hailed for information as to sport obtained, and one of them having got a sail-fish when on the way from Ameni we rowed off to see it. Lighting the lantern I was thrilled to see the lovely fish lying at the bottom of the boat. Upwards of seven feet in length, including the sword of 22 inches, the beautiful Prussian-blue back fin which gives it the local name of *ola-meen*—*ola* meaning a palm leaf—was spread for my inspection. It was for such a fish I had been hoping in vain. Some other time I will perhaps be more fortunate. Flying fish is the bait to use and these were very scarce.

When we returned over the reef we met a strong wind from the north-west so three of the six men towed us along the three miles to camp. A rice boat had arrived with letters from Mangalore, the news including the election of the National Government by a large majority and the death of Admiral Lord Jellicoe. It was midnight before I slept on my camp bed under the stars.

The 'Chetlat' came over from Ameni to take R. A. and me to spend the day there as guests of Mr. A. M. Khan, the Magistrate and Monegar of the Northern Group of the Laccadives. The crew of twelve sang rousing choruses as they rowed lustily along, one of these being 'O! Bela! bela-illa-ela, O! Bela, bela il kandai' in response to tuneful verses sung by one of the rowers as a leader. With the boat were two influential men, Muktesars (Assessors), of the Magistrate's Court, who sit with him during the trial of cases—an excellent system.

It was very interesting to enter the lagoon and see at close quarters the island on which the notorious pirate, Captain England landed in the 17th century after his victory over the French ship 'Cassandre' and permitted his crew to indulge in wild saturnalia of license and rapine. They destroyed coconut groves, set fire to the houses; so that even to the present day, it is the custom of the people to assemble on sight of a strange sail.

Accompanied by an interested crowd we walked with the Monegar to see the principal Mosque and so, beneath the shade of bread fruit trees and palms, to the eastern shore where the attendant people were photographed; then, after partaking of the usual hospitality of coconut milk, we returned along the Seshadri Road, a pathway three miles six furlongs in length, which was made in 1927 and named after an Indian Collector of that name. Its useful purpose is to provide the much-needed definite walking exercise. Mr. Khan is an energetic sportsman so I enjoyed a game of tennis with him and two of the islanders who had taken to the game under his tuition.

This island is even better wooded than Kadamat. There are many fine trees and the people seemed prosperous. The houses looked like small farmsteads. On none of the islands are dogs tolerated; nor, except on Ameni, Kalpeni, and Androth, are there any crows. It is a strange fact that no crow has ever been seen on Kadamat though separated by only five miles of sea. The largest boat is of 35 tons burden, and boat sheds as long as 87 feet. The rainfall is 60 inches, mostly in June, July, August; July is the wettest month. There are 400 occupied houses containing 2,500 people. Sexes are in equal proportion.

Having much enjoyed our interesting visit and the kind hospitality of Mr. Khan, we were rowed back next day in the 'Chetlat', seeing some porpoises on the way. The jovial Muktesar, Avakal Ibrahim, remarked that he was as heavy as a porpoise and was quite disappointed when I proved to him that he could not weigh anything near 600 lbs.!

It was seldom that the wind was too strong to permit fishing outside the lagoons. For two days at Chetlat no one had ventured out, and on one day at Kadamat the wiseacres shook their heads. My boatmen, however, said it would be all right so out we went on the evening of the 6th December crossing the reef as if on the way to Ameni. It was blowing rather hard, and once outside I rather wished myself back again! The white-crested waves looked enormous as the boat fell into the troughs between them where nothing but the angry onrushing water could be seen as I faced the stern. Seated on the floor of the boat I could touch the water with my wrist resting on the gunwale and now and again a splash would curl in from that mere hand's breadth above the surface. When a fish seized the trolling bait and tore the line screaming off the reel I was quite glad it was not securely hooked! The setting sun lit up the heavy clouds to the west in a golden glory and I was relieved when the men explained by signs that no rain would come and the sea would be more quiet to the south of the reef. Confident in their knowledge of the signs of the weather, and the management of the boat they had almost lived in since their earliest days, and that they were as fish in the water which, to a landlubber over imaginative of possibilities in such a situation, seemed eager to engulf us, the men were assured and happy in that desert of angry waves. Indeed I was equally happy—when we had the shelter of the reef!

These islanders are primitive people in many ways. There is the matter of stinking fish. A bait had been left on a hook from the previous day and having been tied on with cotton had to be detached. My proffered scissors were rejected and the threads bitten through, the horrible morsel having necessarily to be pressed against the lips for the purpose. On such occasions I would say to old Ali Muhammad 'Barabar nahin' and he would reply 'Bar-r-rabar' rolling his r's, then I would say 'Hor-r-rible', and we would both laugh. He had a few words of Hindustani having picked these up somewhere on the coast.

On the last evening a flying fish had been obtained as bait and a Kadamat man made a very neat parcel of it by means of leaf fibre as thread and a bit of wood as skewer to keep the lips closed, a method stored in memory in case of need. No sword fish were found. I caught a red perch of 14 lbs., a barracouda of 18 lbs., three caranx 9, 9, 8 lbs., and so ended the fishing for this trip with a total of 17 fish of 122 lbs., for Kadamat and 69 fish of

720 lbs., for the three islands. All far below expectation, as before remarked.

Through an interpreter I learnt a little of the customs of the people. I liked their manners, and was always on good terms with them. Divorce is easy, on Chetlat at any rate, where husbands and wives have experienced several alliances. Divorce is mostly wanted by the wives. If the wife insists the husband has to divorce her but may take back all the jewellery, clothing, etc., which he has given to the woman as dowry. No doubt this acts as a check to errant fancies!

On the evening of the 8th December, at 8-30, I saw a wonderful meteor of a lovely brilliant light of many millions candle power and many colours. It appeared quite close, but there was no report of impact as is usual in such cases. Perhaps it was noticed in India.

On the morning of the 12th the Monegar came over in the 'Chetlat' to see us off, and by 12 o'clock we were out of the lagoon heading for Mangalore a hundred and fifty miles to the north-east. Winds were contrary so we did not get along very fast. On the 14th we were becalmed for some hours, and the dingy coming alongside several fish were seen beneath it. One was quickly caught and proved to be a sucker-fish (*Echeneis*), a curious creature which travels as an uninvited guest attached to a shark, or other big fish, or to a boat. The sucker is a ribbed affair, a sort of extension of the dorsal fin to the head, and when attached to a man's leg, which was the test made, will stand a pull of 16 lbs. Put into reverse gear it is easily detached. At that time also an enormous dorsal fin moved along four or five feet out of the water at a distance of several hundred yards, but what creature it belonged to we could not make out; perhaps it was a Whale Shark (*Rhineodon typicus*) which usually swims near the surface with part of its dorsal fin exposed.

It was not until the afternoon of the 15th December that we landed after a very slow voyage of seventy-five hours. I was tired of my small deck space of six feet by two—no room for a camp bed—and R. A. dead to the world on account of sea-sickness in the rabbit hutch beneath the poop. On getting ashore he could scarcely stand, and took some days to recover. He had worked very hard at collecting all sorts of specimens, and when these have been sorted out and classified with the assistance of the various experts in the different fields of science, intended to publish the results of the trip in the form of a Bulletin of the Madras Government Fisheries Department, but this has not yet been done. (3-4-1940.)

It was sad to part with old Ali, feeling as I did that the cataract operation on his left eye would be probably unsuccessful. A nice old man. We had much enjoyed every hour of the trip. Someday I hope to repeat this memorable adventure and may be get hitched on to sword-fish, saw-fish, and sail-fish, all of which inhabit these seas, of the angling possibilities of which nothing is known as, previous to my visit, there is no record of any sportsman having visited the Laccadives with 'rod and reel'.

Those who wish to know more about the geology, zoology, botany and other facts concerning the Laccadives may refer to Alcock's 'A Naturalist in Indian Seas', to 'Botany of the Laccadives' published in the Journal of the *Bombay Natural History Society*, Vol. viii, pp. 268 and 460, Vol. viii, pp. 57 and 488; and to two sumptuous volumes by Gardiner on *The Fauna and geography of the Maldive and Laccadive Archipelagoes,* obtained on loan from the Zoological Survey, Calcutta. Mr. A. O. Hume visited the Islands in 1875 and published some articles of interest in *Stray Feathers.* Mr. F. N. Betts of Coorg, an ornithologist, visited the Northern Islands for a fortnight in February 1938. His account of that visit, accompanied by a list of 44 birds, will be found at pp. 382-387 of Vol. xl of this *Journal.*

NOTES ON SOME BRITISH INDIAN OTTERS, WITH DESCRIPTIONS OF TWO NEW SUBSPECIES.

BY

R. I. Pocock, F.R.S.

British (Natural History) Museum.

There has been greater confusion over the names and characters of the Otters of British India than of any other group of mammals inhabiting those districts of the Oriental Region. It is not my intention to enter fully in these matters in this paper; but it is necessary to explain that the three species admitted by Blanford, following Thomas, in the Appendix to his volume on the Mammals of British India, p. 602, 1891, are now referred to the three genera: *Lutra,* the so-called Common Otter, *Lutrogale,* the Smooth Otter, and *Amblonyx,* the Clawless Otter. They are found in India and Burma and far to the east and south-east of the latter country; but I am here principally concerned with those occurring in India itself.

An interesting point connected with their distribution in Hindostan has come to light from a study of the skins and skulls obtained by the collectors for the Bombay Mammal Survey. The three are found in the Himalayas and adjoining districts of Northern India and also in Southern India; but the only one that occurs over the whole of Central India as well is the Smooth Otter (*Lutrogale*). The distribution of the other two is discontinuous like the distribution of the Thar and the Yellow-throated Marten.

Not unexpectedly comparison between specimens from the Himalayas and the hills of Southern India shows that they can be sorted into distinguishable local races. In the case of *Lutra* names are available for both series, the South Indian form being *Lutra lutra nair,* Cuvier; and the best known of the three Himalayan races I admit, *Lutra lutra monticola* Hodgson, a larger, lighter coloured Otter. Nothing further need be said about these, except that Pohle gave the name *ceylonica* to Ceylonese representatives of *nair.* This is a synonym of *nair,* since the trivial difference on which Pohle relied breaks down both in Ceylonese and Indian skins.

The Southern Indian race of the Clawless Otter (*Amblonyx cinerea*) requires a new name. There are, in my opinion, three admissible races of this otter, namely (1) typical *cinerea,* described by Illiger in 1815, which is found in Java and other parts of South-eastern Asia, the type being from Batavia; (2) *concolor,* the type of the genus *Amblonyx,* which was described by Rafinesque in 1832 from the Garo Hills, Assam, and ranges from Upper Burma westwards at least to Kumaon, *indigitata* Hodgson and *sikimensis* Horsfield being synonyms of it; and (3) the new form described below.

It may be added that the northern Indian and Burmese race *concolor*—a name with which Blanford was unacquainted—differs from typical *cinerea* in having on the average a smaller, less muscularly moulded skull and the pale hue of the cheek and throat more extensive posteriorly, and more sharply defined from the dark hue of the head and nape above it. The general colour of the upper side is drabby, greyish, earthy or rufous brown in fresh skins.

In addition to a number of old skins in the British Museum from Nepal (Hodgson), including the type of *indigitata,* from Bhutan (Pemberton) and Sadiya (Cockburn), I have seen several, comparatively fresh and unfaded, obtained by the Survey from the following localities:—Naini Tal (Crump); Tura in the Garo Hills, 1,400 ft. (Wells), of special interest as a topotype of *concolor;* Hot Springs, 2,400 ft. and Jowai, 4,500 ft. in the Jaintia Hills (Wells); Dabadubhi River, Golaghat, 250 ft. (Wells); Dikhu River in the Naga Hills, 2,000 ft. (Mills); Pwepi in the Chin Hills, 5,000 ft. (Shortridge); and during the current year, 1939, R. Kaulback has sent me half a dozen specimens from Sumprabum, 1,500 ft., Htingnau, 2,500 ft., Nchangyang, 1,500 ft. and Nanhkang 1,500 ft., all in 'The Triangle', Upper Burma, approximately 26° N. and 97° E.

Amblonyx cinerea nirnai subsp. nov.

Locality of the type.—Virajpet (Virarajendrapet) in South Coorg, 3,000 ft.

Distribution.—The hill ranges of Southern India.

Distinguished from the foregoing race, *concolor,* by the noticeably darker hue of fresh skins, the upper side being very deep chocolate, almost blackish brown, without the paler greyish, drabby or rufous brown hue of the Northern Indian and Burmese form.

Before the Mammal Survey was started, this otter was represented in the British Museum by a couple of unsexed, undated and now faded skins, presented in 1867 by F. Day and merely labelled 'Madras', meaning somewhere in the Presidency. In addition to the type, an adult ♂ collected by Shortridge, the Survey secured specimens at the following localities: Haleri, North Coorg, 3,555 ft. (Graham), a specimen which I have not seen, the Palni Hills 5,800 ft. (McCann), and Ootacamund in the Nilgiri Hills (Gosse). The two from the last locality are a little paler than the type; but a series of four from the Nilgiri Hills recently sent to me by Major Phythian Adams resemble in their dark hue the type and the skin from the Palni Hills. This last-mentioned skin is exceptional amongst Indian skins in resembling Javan skins of typical *cinerea* in the colouring of the cheek and sides of the neck.

The sub-specific name chosen for this otter is, according to Blanford, Kanarese for the other South Indian Otter (*Lutra lutra nair*). But no doubt it applies to the Clawless Otter as well, since Shortridge found them fishing in the same waters in Coorg.

Lutrogale perspicillata Geoffroy.

(*The Smooth-coated Otter*)

This large Otter, hitherto quoted in the literature on British Indian Mammals as *ellioti, macrodus, tarayensis* or *taraiyensis,* *simung,* which belong to it, and as *barang,* which does not, takes the name above assigned to it for reasons to be fully explained elsewhere. It is the most widely distributed of the Oriental genera of the sub-family, ranging from Travancore and Sind in Western India as far east as Borneo. Until 1920 it was treated merely as a well-marked species of *Lutra,* and is still sometimes cited as such; but it differs profoundly from at all events all the Old World species of that genus in the structure of the skull and in some external features, notably, as Hodgson long ago pointed out, in having the end of the tail flattened instead of circular in section.[1] With the Clawless Otter (*Amblonyx*) it cannot be confused on account of the difference between them in the structure of the paws, the tail and some well defined characters in the skull and teeth.

The British Museum has a large collection of specimens, one from Sumatra, the country whence the type of *perspicillata* came, and many from the Malay Peninsula, Indo-China, Burma and India, mostly secured in the last two countries by the Bombay Mammal Survey as the familiar names of the collectors indicate. The localities are as follows: Pegu (Oates), West of Toungoo, 500 to 600 ft. and west of Kindat (Mackenzie); the Chin Hills (Shortridge); the 'Triangle', about 26° N. and 98° E., 1,500 and 3,000 ft., in Upper Burma (Kaulback); Sadiya, 500 ft., Golaghat, 250 ft. (Wells), the Chibi River, 1,500 ft. and the Dikhu River in the Naga Hills (Mills). The Burmese and Assamese specimens from these localities, although individually variable from drabby to very deep chocolate brown do not on the evidence seem distinguishable racially from those found further south which I assign to typical *perspicillata.* But skins from scattered localities in India proper, namely from Nepal (Hodgson), Mt. Abu, Rajputana (Impey), Damoh, 1,200 ft. (Crump), Ghazipur (Flower), Madras[2] (Jerdon), Trivandrum (Ferguson) and the Ankulam Lagoon, Travancore (Pillay) seem to be on the average more rufous or earthy brown than those from Assam and Burma. If further material establishes their racial distinctness, they will take the name *tarayensis* Hodgson, with *macrodus* Gray and *ellioti,* Anderson as synonyms.

There are, however, some additional specimens from the valley of the Lower Indus, mostly collected for the Survey by S. H. Prater which may be regarded as representing a distinct race.

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[1] This peculiarity is very manifest on well preserved dried skins in which the terminal part of the tail appears to be keeled on each side.

[2] Skins and skulls of an adult ♂ and ♀ with this history are the cotypes of *macrodus* Gray which by some strange mistake he described as having come from South America. Perhaps stranger still was the failure to detect that mistake by the authors who subsequently handled the specimens and discussed the status of *macrodus.*

Lutrogale perspicillata sindica subsp. nov.

Locality of the type.—Chak in the Sukkur district of Sind.

Distribution.—The Indus valley at least from Bahawalpur southwards to Sind.

Distinguished on the average from representatives of *L. perspicillata* inhabiting the rest of Hindostan by its noticeably paler colour, in accordance no doubt with the more arid nature of its habitat, the general hue of the upper side being drabby, tawny or sandy brown instead of darker brown with a rusty tinge.

I have seen in all 7 skins of this otter from the Lower Indus. One labelled Sind, another Sukkur, Sind, were sent to the British Museum many years ago from the Karachi Museum. Two were collected by Prater at Sukkur and three at eastern Nara, Khairpur. None of the specimens is quite full grown as the skulls indicate. The Khairpur skins are a trifle darker than those from Sukkur, thus approaching those from other parts of Peninsular India; and a young specimen, about one-third grown, from Bahawalpur (J. Scully), is also darker, not very different from the type of *tarayensis,* Hodgson from the Nepal Tarai. Possibly young specimens of *sindica* are darker than adults.

Both Hume and Blanford who saw at least one example of this otter in Sind, thought it differed from the ordinary Indian form by its smaller size. This supposition is not borne out by the flesh-measurements Prater recorded or by the skulls he secured. His type, a young adult ♀, measured: head and body 25 4/5 in., tail 17 4/5 in.; hind foot 5¾ in. Its weight was 16 lb. Hodgson gave the dimensions of the head and body of Nepalese specimens of the Smooth Otter as from 26 to 28 in., the tail 16 in. and the weight from 16 to 20 lb. The largest British Indian specimen I have seen is one of Mackenzie's from west of Kindat, an adult ♂ with the head and body 29 3/5 in., the tail 17 in., the hind foot 5 3/5 in. and the weight 24 lb. Dunbar Brander recorded the weight of a large ♂, which he identified as the Common Otter (*Lutra vulgaris*), from Central India, as 22 lb.

Hume's account, quoted by Blanford, of this Otter being trained in Sind for capturing fish and porpoises was confirmed by Prater who wrote: ‘Otters are not uncommon in the Indus and Eastern Nara. They are kept by the Muhanas (fishermen) who employ them as decoys for capturing dolphins (*Platanista gangetica*) and fish. Two or three tame otters are let into the river and food in the shape of fish or prawns is thrown to them, whereupon there ensues a great mewing and splashing, and the commotion attracts the fish which blunder into the nets prepared for them.”

The range of this Otter beyond the lower Indus is unknown. Conceivably it extends into Baluchistan and may indeed be the same as the otter recorded as *Lutra vulgaris* by Pitman who saw the tracks on the Tigris and Euphrates. (*Journ. Bomb. Nat. Hist. Soc.,* xxviii, 1922, reprinted p. 319 in ‘A Survey of the Fauna of Iraq’ published by the Society, 1923). But this Mesopotamian otter is more likely to be *Lutra lutra seistanica* Birula, which presumably was assigned to its correct genus.

THE GAME FISHES OF INDIA [1]

BY

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(*With one coloured plate, two black and white plates and one text-figure*).

(*Continued from page* 285 *Vol.* xli, *No.* 2).

IX.—THE MAHSEERS OR THE LARGE-SCALED BARBELS OF INDIA.

2. THE TOR MAHSEER, *Barbus* (*Tor*) *tor* (Hamilton).

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INTRODUCTION.

In the preceding article of this series (**7**)[2] reference was made to the confusion that prevails in the taxonomy of the large-scaled Barbels of India, popularly and collectively known to anglers as Mahseer, and an attempt was made to define the precise specific limits of Hamilton's (**6**, p. 303) *Cyprinus* (*Cyprinus*) *putitora,* the largest Indian carp. The nomenclature to be adopted for fishes of this type was also discussed, and, very tentatively, their retention in the genus *Barbus* Cuvier and subgenus *Tor* Gray was suggested. Hamilton's second species of the large-scaled Barbels, *Cyprinus* (*Cyprinus*) *tor* forms the subject matter of this article.

NOMENCLATURE.

To elucidate further the systematic position of the large-scaled Barbels of India I enquired of Mr. J. R. Norman of the British Museum as to the suitability of using the generic designations

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[1] Published with permission of Director, Zoological Survey of India.

[2] Numerals in thick type within brackets refer to the serial numbers of the various publications listed in the bibliography at the end of the paper.

Barbus Cuvier, *Tor* Gray or *Labeobarbus* Rüppel for these fishes. Dr. E. Trewavas attended to this enquiry and wrote me as follows in her letter of the 25th August, 1939:—

> 'Your letter to Mr. Norman about the nomenclature of the Mahseer came just as Mr. Norman was about to leave for his holiday. His opinion was that until someone revises the whole *Barbus* complex it is premature to split *Barbus* sensu lato into genera but that the Mahseer is probably at least subgenerically distinct from *Barbus barbus* and that *Tor* can be used provisionally as a subgeneric name, provided it is not antedated by *Labeobarbus.* I have looked up the original use of *Labeobarbus* (van Hasselt 1823, reprinted 1824—I have seen the 1824 reference). It was then used for *L. leptocheilus* and *L. lipocheilus.* It is doubtful whether this was a valid proposition of the genus for those two species, but in any case the name *Labeobarbus* cannot afterwards be used for the Mahseer.'

As I could not find any reference to *Labeobarbus* van Hasselt in Weber and de Beaufort's *Fishes of the Indo-Australian Archipelago* or in Jordan's *Genera of Fishes,* and as *Bull. Sci Nat.* (Férussac), II, 1824, in which abstracts from van Hasselt's letters on the fishes of Java were published, was not available in India, I requested Prof. L. F. de Beaufort of the Zoologisch Museum, Amsterdam, to further elucidate the status of *Labeobarbus* van Hasselt as used for *L. leptocheilus* and *L. lipocheilus.* He very kindly sent me the following opinion in his letter of the 6th October, 1939:—

> 'As you know, van Hasselt used to write letters from Java to Temminck and abstracts of these have been published in *Algemeene Kunsten Letterbode,* a periodical of that time. The letters were written in Dutch.
>
> 'Now de Férussac republished some of these letters in his *Bulletin des Sciences naturelles* and so I find in Vol. II, 1824, p. 374 a translation of a letter, written by van Hasselt on December 29, 1822, and published in the *Alg. Kunsten Letterbode,* 1823, Augustus, No. 35. In this letter van Hasselt says (p. 376 of the *Bull. Sci. Nat.* II):
>
> 'Le genre *Labeobarbus* consiste en *Labeones* avec quatre barbillons et une nageoire, dorsale, dont le deuxième rayon n'est pas dentelé ; il réunit donc les caractères du *Labeo* et du *Barbus;* c'est pourquoi j'ai formé le mot *Labeobarbus.* Les épithètes *L. leptocheilus* et *lipocheilus* (m), distinguent les deux espèces qu'on trouve dans la rivière auprès de Batavia, et dont j'ai les dessins.'
>
> '*Labeobarbus leptocheilus* has been described by Cuvier and Valenciennes as *Dangila leptocheila* (synon. of *D. cuvieri*) and *L. lipocheilus* as *Chondrostoma lipocheilos* (=*Tylognathus hispidus* C. V.).
>
> 'I hope that *Dangila* has not to give way for *Labeobarbus,* but I fear the worse.'

In the light of the observations made in the above correspondence, I have re-examined the evidence for using *Tor* Gray as a subgenus of *Barbus* Cuvier for the Mahseers of India, and find that the course adopted in my first article of the sub-series is the only one possible under the present circumstances.

The above correspondence makes it abundantly clear that *Labeobarbus* Rüppel (1836) cannot now be used as a generic name for any group of animals and that it is probably not distinct from *Tor* Gray (1833). Further, *Labeobarbus* van Hasselt (1823), which is sufficiently well characterised to satisfy all the requirements of the International Rules of Zoological Nomenclature, replaces *Dangila* Cuvier and Valenciennes (1842).

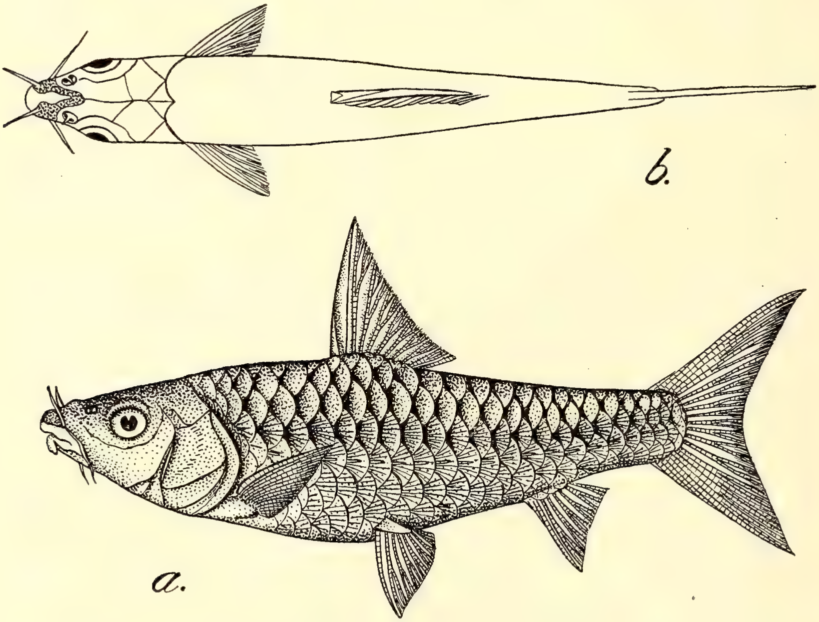
HISTORY AND DESCRIPTION.

Hamilton (**6**, p. 388) characterised his *Cyprinus tor* as follows:—

> 'Cyprinus verus cirrhis 4; radiis in pinna dorsi 11, quorum 3 priores simplices, in anali 8; squamis maximis; rostro laevi imperforato; labiis integerrimis; pinnis inferioribus rubicundis.
>
> 'B 3, D 11, P 18, V 9, A 8, C 19†.'

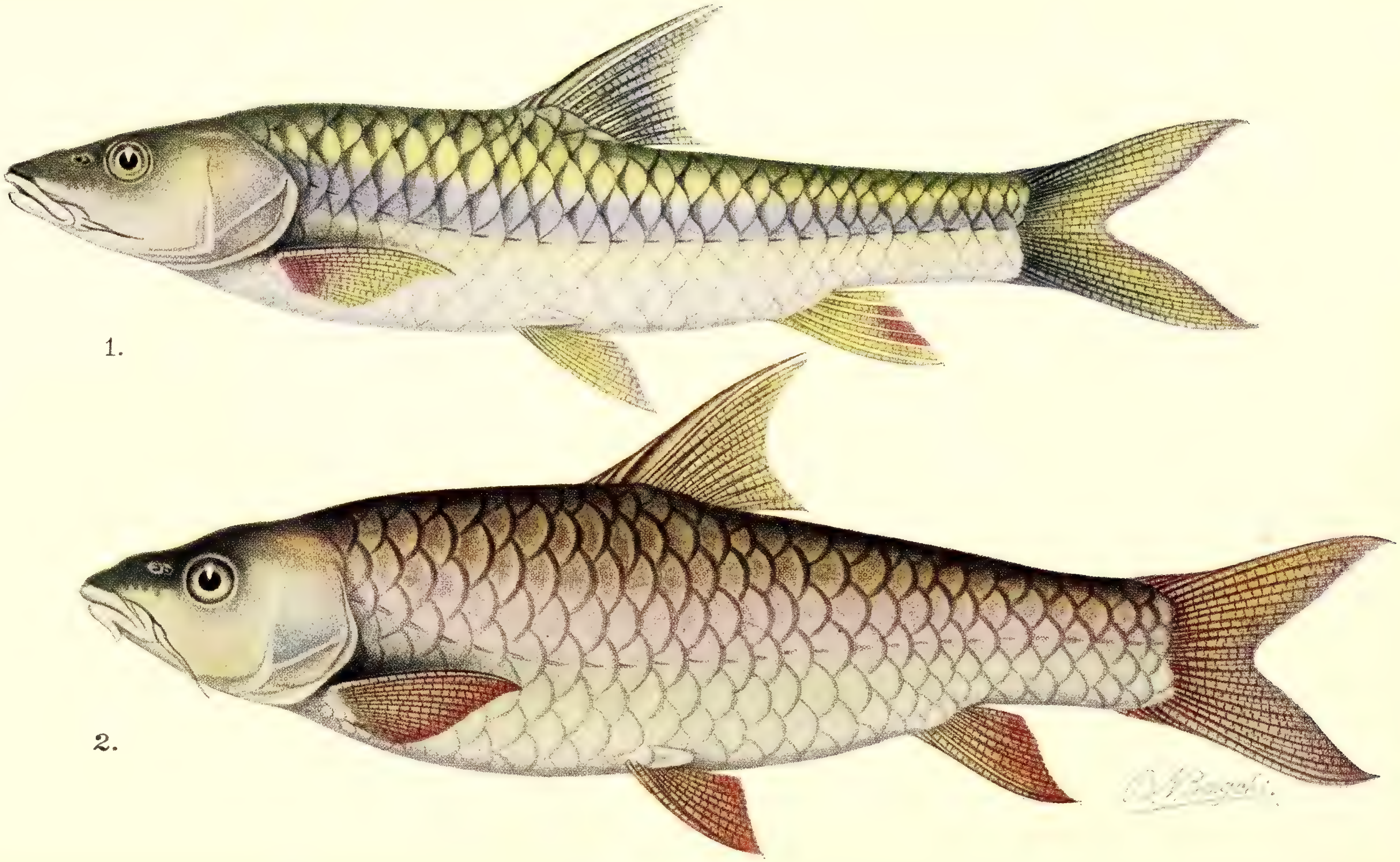
This species was found by Hamilton in the Mahananda River where it was stated by him to grow to three or four feet in length. According to his notes on the fish and fisheries of Bengal (*vide* Day, **2**, pp. 50, 60, 90) Tor Mahseer seems to be more widely distributed than the Putitor Mahseer, for he recorded it from the districts of Rangpur, Purniah, and Behar and Patna. In the list of fishes of the Rangpur District, Hamilton compares it with the Putitor Mahseer as follows:-

> 'The *Tor* of the Tista does not grow above two feet in length, but its scales are as large in proportion as those of the last-mentioned fish, and its colours are more splendid, almost equal in beauty to those of the Rohit.'



Text-fig. 1.—Copies of Hamilton's original drawings of *Cyprinus* (*Cyprinus*) *tar* (MS. drawing No. 121, vol. iv, A.S.B. Library).
a. Lateral view; *b.* Outline sketch of dorsal view.

Hamilton mentions that on the Kosi this fish is called *Tŭrĭyā́* or *Săhărā́* and on the Son *Kajrā́*, and 'is one of the best fresh water



1. THE PUTITOR MAHSEER, Barbus (Tor) putitora (Hamilton) ;

fishes that I have tasted. It grows to fully as large a size as the Rohu.'

Though Hamilton's detailed description is of a very generalised type, fortunately he made a drawing of the species which is now preserved among a collection of his manuscript drawings in the library of the Royal Asiatic Society of Bengal. It was published in colour by Gray (**4**, vol. ii, pl. xcvi, fig. 1) as *Tor Hamiltonii* without any acknowledgment or letterpress; a copy of the original is reproduced here for ready reference. Though Günther (**5**, p. 130) considered this species to be a synonym of *Barbus mosal* (Hamilton) the majority of the later workers followed Day (**3**, p. 564) and used *Barbus tor* (Hamilton) in a very wide sense to include practically all types of large-scaled Barbels of India. Hora and Mukerji (**8**, p. 140), as a result of the collections made by them in the Eastern Doons, were able to assign a definite specific limit to Hamilton's *Cyprinus tor,* a form in which the head is considerably shorter than the depth of the body and the lower fins are reddish in colour. From Hamilton's descriptions of *C. putitora* and *C. tor* the following differences may be noted:-

Cyprinus putitora.	Cyprinus tor.
1 Grows to 9 feet in length.	Grows to 3-4 feet in length.
2. Oblong compressed form.	Long compressed form, rather more prominent below than above.
3. Colour above dusky, with gloss of steel; edges of scales change from gold to silver; lower part silvery; fins without spots, hinder ones tinged with yellow.	Colour above shines with gold and green, below like silver; fins without spots but those on belly coloured red; dorsal fin and portion above eyes dotted.
4. Head blunt, oval.	Head sharpish, half-oval (being flattish above); a protuberance between nostrils.
5. Back forms a sharp ridge. Tail suddenly narrowed behind anal fin.	Back has a blunt or convex edge.
6. Pectorals with 15 rays.	Pectorals with 18 rays.

In the coloured plate (Plate I), which accompanies this article, I have given drawings of the young specimens of the Putitor (Plate I, fig. 1) and Tor (Plate I, fig. 2) Mahseers respectively from the Tista River in the Kalimpong Duars in order to clarify the differences between the two forms tabulated above from their original descriptions. It should, however, be remembered that though the colour sketches were made in the field from fresh specimens, the specimens had been out of water for several hours when purchased from the Washabari Bazaar several miles away from the river. Though the Tor Mahseer was originally described from the north-eastern parts of Bengal, it is now known to be widely distributed and is described below from a number of different localities.

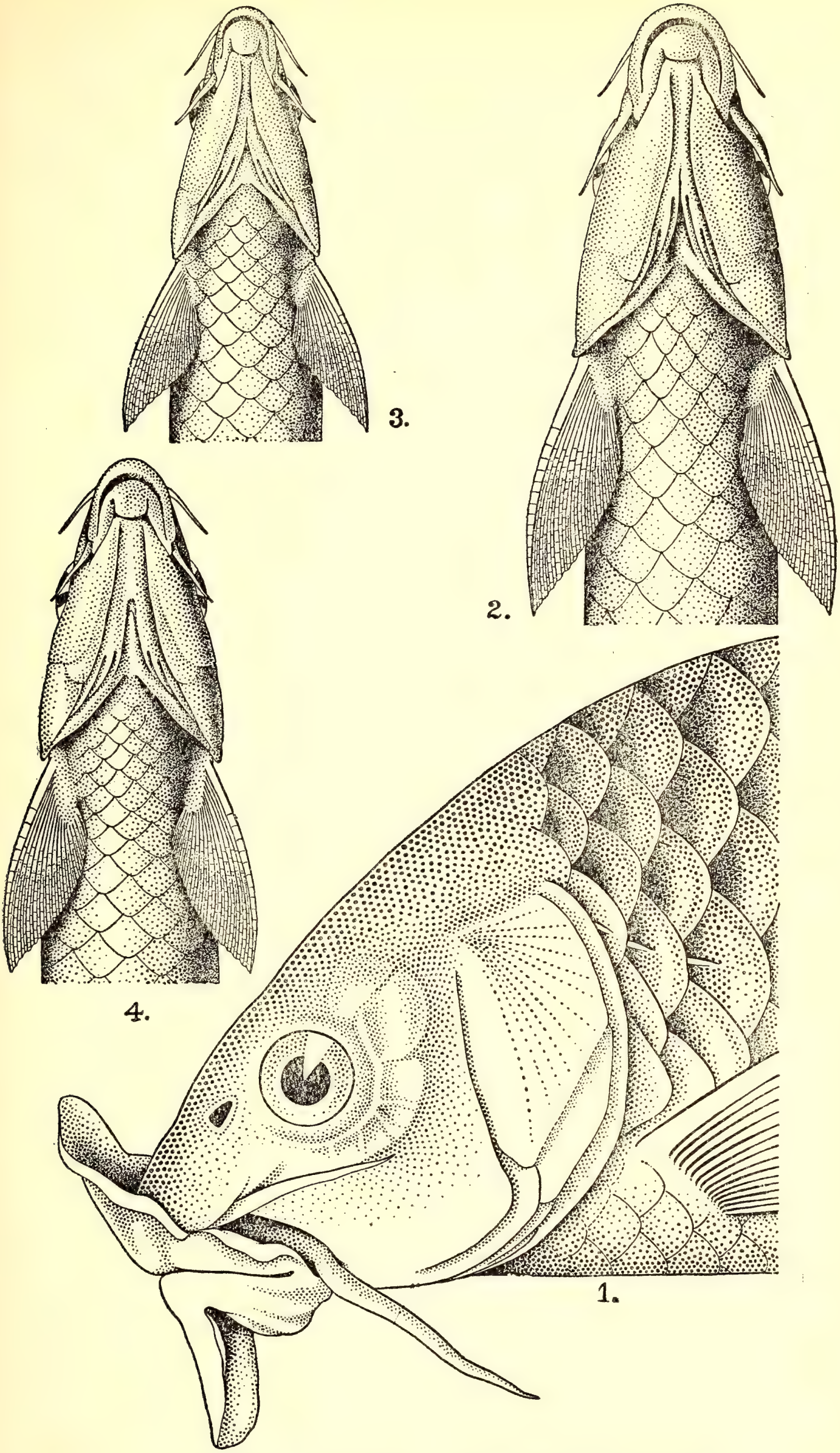
Barbus (Tor) tor (Hamilton).

1822. *Cyprinus* (*Cyprinus*) *tor*, Hamilton, *Fish. Ganges*, pp. 305, 388.
1833. *Tor Hamiltonii*, Gray, *Ills. Ind. Zoology*, II, pl. xcvi, fig. 1.
1919. *Barbus putitora*, Annandale (*nec* Hamilton), *Rec. Ind. Mus.* XVI, p. 136, pl. iii, fig. 15.
1936. *Barbus tor*, Hora & Mukerji, *Rec. Ind. Mus.*, XXXVIII, p. 139.
1936. *Barbus tor*, Hora, *Rec. Ind. Mus.*, XXXVIII, p. 326, text-figs. 5, 6.

D. 4/8; 3/5; P. 15-18; V. 9; C. 19†.

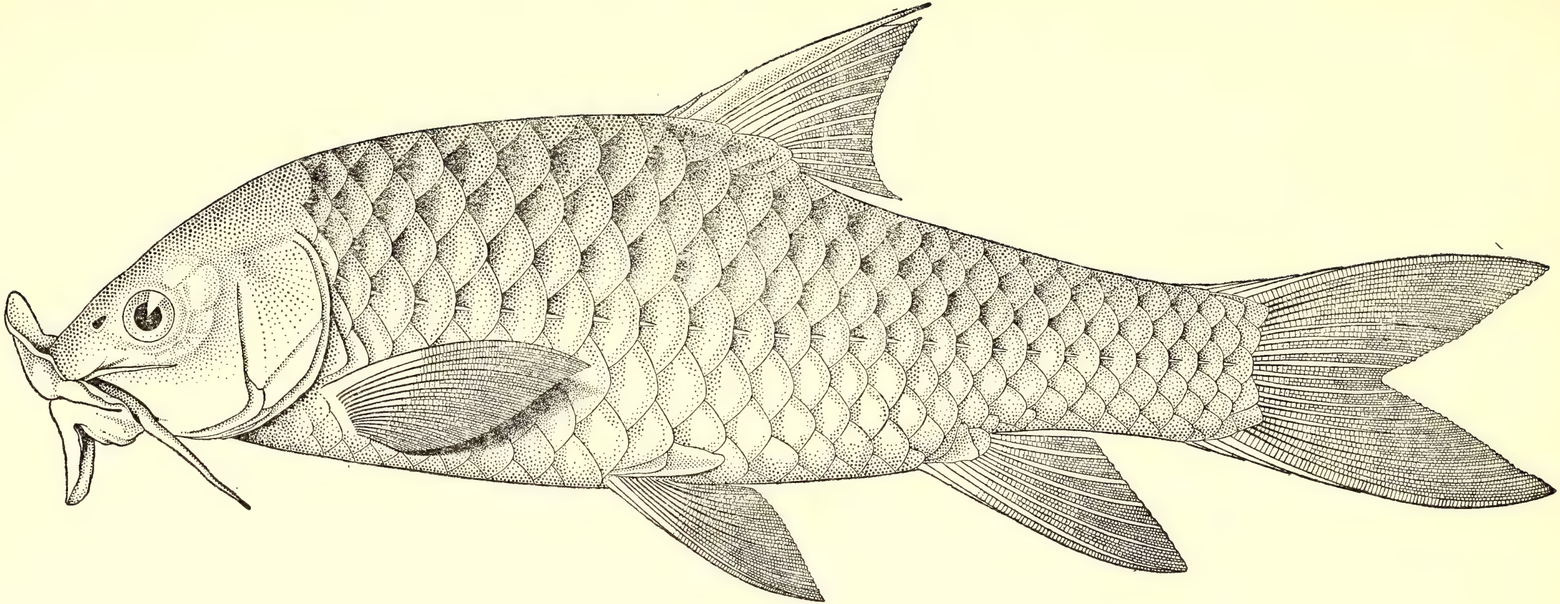
The Tor Mahseer is more stoutly built than the Putitor Mahseer and, as pointed out by Hamilton, it is somewhat compressed with the ventral profile more prominently arched than the dorsal. The head is proportionately smaller than that of the Putitor Mahseer and is sharpish anteriorly; with the exception of very young specimens, it is always shorter than the greatest depth of the body. The length of the head is contained in the standard length from 3·4 times in the young specimens to about 4 times in older individuals. The depth of the body is almost equal to the length of the head in young examples up to about 100 mm. in total length but in older specimens the head is invariably shorter than the depth of the body; the length of the head is contained from 1·0 to 1·3 times in the depth of the body. The depth of the body is contained from 3·0 to 3·7 times in the standard length. The eyes are situated nearer to the tip of the snout than to the hind border of the operculum and are provided with circular pupils. The eyes are proportionately larger in smaller individuals; the diameter of the eye is contained from 2·5 to about 4 times in the length of the snout and from 0·7 to 1·8 times in the interorbital distance. The least height of the caudal peduncle is contained from 1·2 to 1·4 times in its length.

The mouth is small; its gape does not extend to below the eyes; it is horizontal with the opening obliquely directed upwards. The lips are fleshy and continuous at the angles of the mouth; the posterior lip is invariably produced into a median lobe and the post-labial groove is continuous. As pointed out in the case of the Putitor Mahseer (**7**, pp. 279-282), the condition of the lips varies considerably in different specimens irrespective of size. In the Dehra Dun examples, ranging in length up to 270 mm., the lips and the median lobe are poorly or moderately developed (Plate II, figs. 2-4) while in the specimens from the Tista River they are fairly well developed. The greatest development of the lips has been noticed in a specimen 485 mm. in total length, from the Barak River, Assam (Plate II, fig. 1; Plate III), while in the largest specimen examined (Brahmaputra River, Guhauti, Assam) the lips are described by Annandale (**1**, p. 136) as 'thick and fleshy but not produced forwards; the lower lip is slightly retroverted in the middle line'. There are two pairs of well-developed barbels; the maxillary are slightly longer than the rostral but are shorter than the diameter of the eye. The body is covered with large scales; there are 22 to 27 scales in a longitudinal series along the lateral line and 2½ rows between the lateral line and the base of the pelvic fin. The general lepidosis is not very different from



Types of Lips in Tor Mahseer, *Barbus* (*Tor*) *tor* (Hamilton).

For explanation see end of article.



Lateral view of specimen of *Barbus* (*Tor*) *tor* (Hamilton) from the Barak River, Assam. × *ca* 2/5.

that described for the Putitor Mahseer. There is a well-developed scaly appendage in the axil of each pelvic fin.

The dorsal fin commences opposite to or slightly in advance of the pelvics, and its position in relation to the tip of the snout and the base of the caudal fin varies with the size of the specimen; the last spine is strong and bony, and is invariably shorter than the depth of the body below it. The pectoral fins are low, slightly shorter or longer than the head, and are sharp above. The pelvic fins are also sharp and do not extend to the anal opening. The caudal fin is deeply forked with both the lobes sharply pointed.

Hamilton (**6**, p. 305) noted that 'Above its *colour* shines with gold and green, below like silver. The fins have no spots, but the dorsal one is dotted. The eyes are silver coloured with some dots above.' He also noted that the fins on the belly are of a reddish colour. In a small, fresh specimen, about 193 mm. in standard length, collected from the Tista River but purchased at the Washabari Bazaar in the Eastern Duars several hours after its removal from water, the dorsal surface of the body was of a greyish-green colour and that of the head neutral green. The sides of the body in the middle were of a pinkish colour which was replaced above by greenish gold and below by light olive green. The head was variegated with patches of light orange above the gill-opening, of light Indian yellow below the eyes and of light sky blue on the operculum. The lips and barbels were of a light yellowish colour. The dorsal fin was reddish buff while the pectorals, pelvics and anal fins were of deep orange colour. The upper lobe of the dorsal fin was light orange while the lower lobe was of a bluish pink colour. A drawing of this specimen, in original colours, is reproduced here on Plate I as figure 2.

Bionomics:—As a result of their studies on the material collected in the Eastern Doons, Hora and Mukerji (**8**, p. 141) made the following observations on the feeding habits and the breeding period of the species:—

> '*B. tor* is a common food fish and by the local people it is believed to be more powerful than *Mahseer, B. putitora.* The intestine is moderately long and convoluted; its length is equal to about 4·5 times the total length of the fish. It feeds preferably on filamentous algae and water plants, but in some cases young Gastropod molluscs, sand and gravel were found among the stomach contents. The young specimens were found to feed on slimy matter encrusting rocks and stones.
>
> 'From the presence of a large number of young specimens in our collection, it would appear that the fish breeds in August-September. The fry is characterised by a black spot before the base of the caudal fin.'

Geographical Distribution:—In the present state of our knowledge, it is not possible to give a precise idea of the geographical distribution of *B. tor,* but probably it is widely distributed along the foot-hills of the Himalayas. I have examined young specimens from the Doon Hills; Saran District, Bihar; Tista River below Darjeeling Himalayas; the Brahmaputra and the Barak rivers in Assam. I have also examined a specimen from Bilaspur in the Central Provinces which agrees fairly closely with the Himalayan specimens of *B. tor* but its fins are considerably smaller and the

MEASUREMENTS IN MILLIMETRES

	Dehra Dun						Bihar	Tista River				Gauhati, Assam	Bilaspur, C. P.
Total length ...	150·0	155·0	166·0	181·5	186·5	270·0	166·0	65·0	...	157·6	234·0	485·0	...
Standard length ...	115·0	119·0	125·0	134·5	140·6	214·0	126·0	48·0	101·5	125·0	189·0	360·0	252·0
Length of head ...	30·5	29·6	32·5	34·0	37·0	54·3	33·0	14·0	25·5	34·5	47·5	96·5	62·5
Height of head ...	24·5	23·0	23·5	25·3	27·2	40·5	24·0	10·0	19·0	23·3	33·0	77·5	44·0
Width of head ...	19·3	18·5	18·5	21·0	21·5	33·6	21·5	7·0	15·5	17·5	28·0	60·2	35·0
Diameter of eye ...	9·5	8·5	9·5	9·5	10·5	12·5	10·0	5·7	8·5	9·0	12·0	24·0	15·0
Length of snout ...	10·0	9·5	10·5	10·5	12·5	16·5	9·8	5·0	9·0	12·0	16·1	33·5	18·5
Interorbital distance ...	10·0	10·0	11·0	11·2	12·5	19·4	12·0	4·1	8·5	11·0	17·3	43·0	22·3
Depth of body ...	35·0	37·3	42·0	43·0	43·0	64·0	42·0	15·0	33·0	37·0	51·3	121·0	77·0
Width of body ...	18·5	21·9	18·5	22·3	21·0	35·0	23·0	6·0	15·5	18·0	27·0	54·0	35·0
Length of caudal peduncle	18·0	19·5	22·0	23·5	23·5	36·0	19·5	7·0	16·0	20·0	30·0	62·0	39·0
Least height of caudal peduncle ...	14·5	16·0	16·5	18·3	17·8	26·0	16·0	7·0	13·5	15·3	23·5	51·0	35·5
Length of dorsal fin ...	29·0	29·0	34·5	36·2	34·0	51·0	32·0	14·0	25·5	32·0	44·3	87·5	53·0
Length of pectoral fin ...	21·5	24·5	25·0	26·0	27·0	40·0	27·5	11·0	20·0	26·3	32·5	87·5	48·5
Length of pelvic fin ...	19·2	20·5	20·3	24·0	23·0	33·0	25·5	9·0	17·0	21·0	28·1	77·0	41·0
Length of anal fin ...	20·5	22·0	24·0	24·0	25·0	37·0	26·0	8·5	18·5	25·0	30·5	81·0	43·0
Length of rostral barbel.	6·0	6·0	6·0	7·3	6·5	12·5	5·5	3·0	5·5	7·1	10·0	31·5	8·0
Length of maxillary barbel ...	7·0	7·3	7·0	7·5	7·0	14·0	9·0	3·5	7·0	10·4	12·0	37·0	13·5
Scales along lateral line...	25	27	25	24	25	26	25	22	25	22	26	25	25
Scales between lateral line and v. ...	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½	2½

caudal peduncle is more stumpy. In these respects it corresponds with the Assam example described by Annandale as *B. putitora*, but which in reality belongs to *B. tor*.

ACKNOWLEDGMENTS.

As in the case of the previous articles in this series, the cost of illustrating this article was borne by the Bombay Natural History Society and for this my sincerest thanks are due to the authorities of the Society. I am indebted to Mr. K. S. Misra for preparing the table of measurements. The colour drawings are the work of Babu B. Bagchi, while the text-figures were prepared by Babus B. Bagchi and A. Mondul. I am thankful to them for the skill and care with which they executed the work under my supervision.

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EXPLANATION OF PLATES.

Plate I.

Two types of Mahseers from the Tista River.

Fig. 1.—The Putitor Mahseer, *Barbus* (*Tor*) *putitora* Hamilton (*Vide supra* p. 521) × $\frac{3}{4}$.

For description of colour see the preceding article of this series (**7**, p. 278).

Fig. 2.—The Tor Mahseer, *Barbus* (*Tor*) *tor* (Hamilton) (*Vide supra* pp. 521-523) ×$\frac{3}{4}$.

Plate II.

Types of lips in Tor Mahseer, Barbus (Tor) tor (*Hamilton*).

Fig. 1.—Lateral view of head and anterior part of body of a specimen, 485 mm. in total length, from the Barak River, Assam, showing greatly hypertrophied lips x 4/5.

Figs. 2-4.—Ventral surface of head and anterior part of body of 3 young specimens of *Barbus* (*Tor*) *tor* (Hamilton) from the Eastern Doons, showing stages in the enlargements of the lips and of the median lobe. ×$1\frac{1}{3}$.

Plate III.

Lateral view of the specimen of *Barbus* (*Tor*) *tor* (Hamilton) from the Barak River, Assam, x *ca.* 2/5.

NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

(*With* 6 *plates*).

IV.—THE MANBHUM DISTRICT.

(*Continued from page* 424 *of Vol.* xl).

At the end of 1932, when I married, I had already made up my mind to give up bird photography as I felt it would not be right to continue taxing my health and strength to the extent which the work involves in the plains. In the beginning of the following February, however, I was unexpectedly posted to Dhanbad, in the Manbhum District. Here, the graceful slopes of Parasnath, the highest hill in Bihar, with the beautiful forest country round the Topchanchi reservoir at its feet, held out such promises of a rich and varied bird life, that my intentions were quickly forgotten, and I soon found myself keener than ever in the pursuit of my hobby. As a result I can now claim that never before, nor since, have I been so successful with the camera as I was during the three years I was stationed in this district. Let me say at once that during this period I added the photographs of sixty-seven new birds to my collection, a fact which, perhaps, justifies an attempt to describe my camera experiences here, or rather in that part of the district which forms the Dhanbad sub-division.

It is not only on account of its wonderful bird life that the Manbhum district will always remain green in my memory; it was here too that my wife and I were shown such kindness and received such hospitality on all sides from the mining community as we feel cannot exist elsewhere in India. But this is not all; it was in this district also that I first made the acquaintance of Sakroo Mahato. Aged about thirty, on the small side, but well built and wiry to a degree, he was intelligent above his station and was recommended to me by a friend who had found him to be a big game *shikari* possessing considerable knowledge of bird and insect life as well. Sakroo's boyhood, as I came to know later, was spent looking after cattle and goats, and in those early years he had mastered the art of snaring birds at their nests and learnt not only to distinguish the calls and notes of the different species to be found near his home, but also to imitate them. I have told elsewhere of how, when he first came into my service, Sakroo performed the almost incredible feat of finding *twelve* Nightjars' nests in one day. Nevertheless, in spite of his knowledge of birds and their nests, Sakroo's ignorance with regard to some of the resident species was amazing. For instance, although he knew the Rock Horned Owl and could imitate its call to perfection, he had no idea of where to look for its eggs, nor did he know that Crested Swifts were to be found near his home, and he had failed to connect the Pitta with its nest. I could continue quoting such instances but I prefer to remember Sakroo for his virtues, one of which was his aptitude to learn. This, and the other gifts with which he had been blessed by Nature, coupled with the fact that he was working on his own terrain, which he knew as well as the palm of his hand, made me soon realise that in Sakroo I had a *shikari* without peer.

Having praised Sakroo according to his deserts, I am reminded of another *shikari* (Guffara, of Shalabug, near the Anchar Lake), who was in my employ during 1924 and 1931. When the time came for me to return to duty at the end of my first visit to Kashmir, Guffara wanted a *chitty* to enable him to secure employment in the future, and, *sui more*, produced a number of letters given by previous employers, to guide me as to what I was expected to say of him. These were kept carefully in the cover of an old novel given him by a '*Captan Sahib*' who must have possessed a delightful sense of humour as the title of the novel was *All Men are Liars*. But it is high time I returned to my muttons and said something concerning the district.

The Manbhum district is frequently referred to in the *New Fauna* and elsewhere as being in Bengal whereas in fact it forms the eastern part of the Chota Nagpur division in Bihar and lies between 22° 43′ and 24° 4′ North Latitude and 85° 49′ and 86° 54′ East Latitude. It contains an area of 4,147 square miles and is bounded on the north by the districts of Hazaribagh and the Sonthal Parganas; on the east by Burdwan, Bankura and Midnapore—all part of Bengal; on the south by Singhbhum, and on the west by Ranchi and Hazaribagh. Purulia is the administrative head-quarters, but the district is divided into two parts, Dhanbad being the head-quarters of the sub-division with an area of 803 square miles.

The country generally is flat, with a gradual fall in an easterly direction. On the north-west is a range of hills, some of considerable height, with the south-eastern slopes of Parasnath (4,480 feet) just inside the district. With the exception of a fair amount of rice cultivation there are no agricultural activities, the majority of inhabitants being occupied in mining coal, in the output of which mineral the Jharia field, situated in the district, is far and away the largest in India.

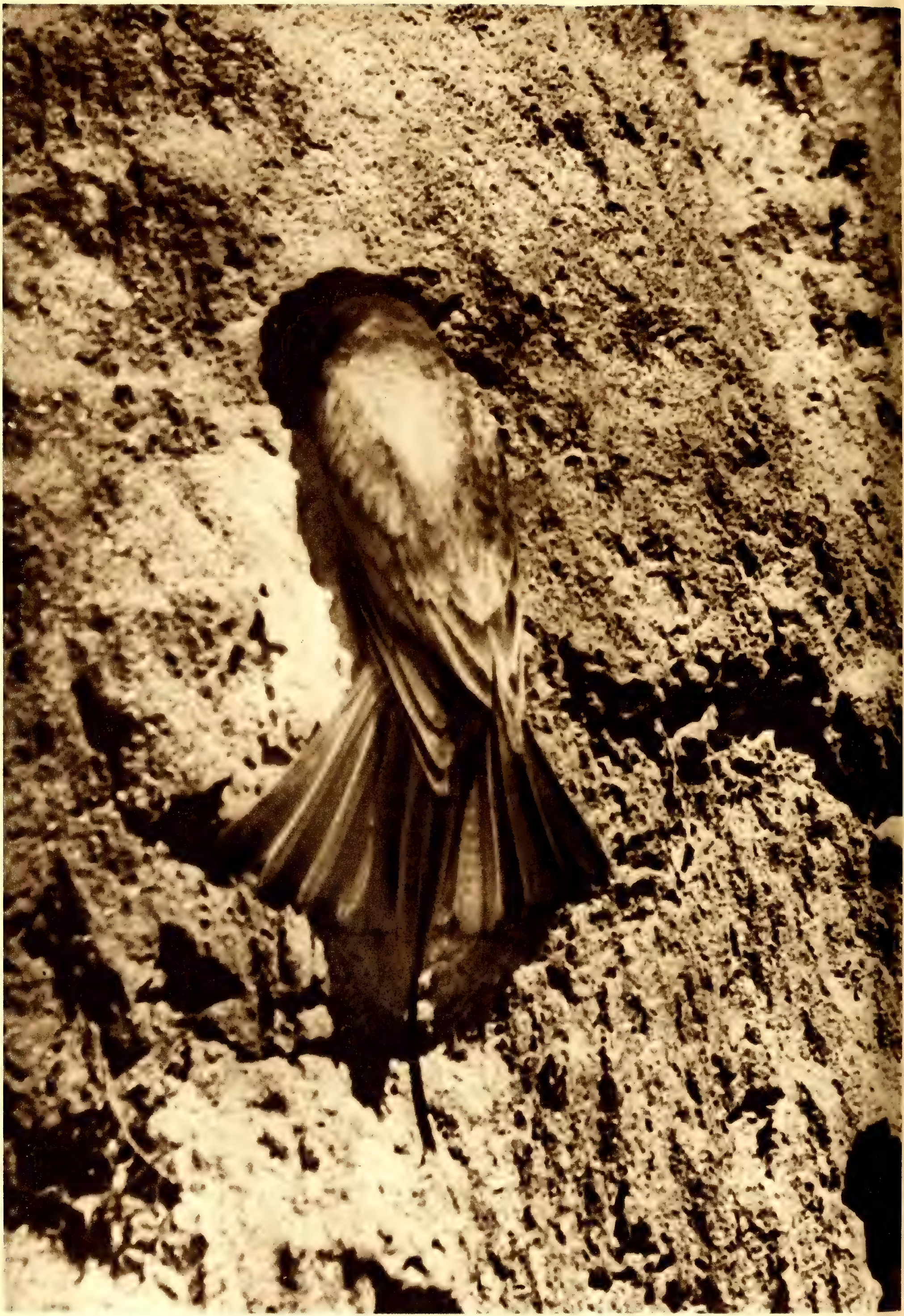
Except along the Grand Trunk road, and in the vicinity of the hills in the north-west of the district, trees are comparatively few in number, and the only jungle that exists is also to be found on these same hills. The commonest tree, and one which is plentiful, is the Flame of the Forest or *palas*. Others frequently met with are the mango, *pipal, mhowa, simal* and *jamun*, and on the hill sides, bamboo.

All the rivers have an easterly or south-easterly course, and as is usual with hill-fed streams, their beds are almost entirely dry during the greater part of the cold season, and throughout the hot weather. They are not navigable and are subject to sudden and violent freshets which are usually of short duration. The principal rivers are the Barakar, which marks the whole of the northern boundary, and the Damodar, which, roughly speaking, divides the district into two parts, and which, with the Barakar, also divides the district from Burdwan.

Several tanks overgrown with weeds exist, but with the exception of the Jharia Water Board's reservoir at Topchanchi, there is no water of any expanse; consequently any species of duck is a *rara avis*, though snipe are fairly plentiful in the paddy fields during the winter months. Cattle and Little Egrets abound, while most ponds with any vegetation round their edges are tenanted by at least one pair of Dabchicks, Moorhens and Bronze-winged Jacanas. Round the Topchanchi reservoir an occasional Grey and Purple Heron, and more rarely a Black Ibis, may be seen, but where they breed I never found out. The Night Heron, Little Cormorant and Whiskered Tern breed locally in colonies, but, speaking generally, the district is not popular with water-fowl or waders.

Considering the limited area suitable to their existence, game birds, if not common, are nevertheless not poorly represented. Red Jungle-fowl, Painted Spur-fowl and Peafowl occur in small numbers, but only in the vicinity of the well-wooded hills. Because of persecution both by the gun-license holder and the Sonthal, all three species are intensely shy and difficult to approach and seldom come out into the open except to drink, towards dusk. In this connection I ought to mention that the colliery manager is a very keen *shikari*, and many spend all Sunday in quest of what they may obtain, frequently motoring out fifty or more miles *pour la chasse*. The Sonthal is an even mightier hunter, and being a deadly shot with bow and arrow, and carrying these at all times, whether in the field or jungle, is greatly responsible for the small number of game birds found. In suitable country, Grey Partridge are to be seen, and more frequently heard, but the Black Partridge I came across only occasionally, and then always near the Jamuni river. The Jungle Bush-Quail occurs locally but the Common Indian Bustard-Quail is fairly numerous in cultivation and scrub. The Common Sand Grouse and Painted Partridge I never saw though I have shot both (each once only) in the neighbouring district of Hazaribagh, fifteen miles distant from Parasnath. The Stone-Plover is somewhat scarce, a remark which also applies to the Yellow-wattled Lapwing, but the Green Pigeon plentiful. I never saw the Emerald Dove, and the Purple Wood-Pigeon but once.

The scrub jungle harbours a wealth of bird-life—Common and Franklin's Nightjars, Ioras, Thick-billed and Tickell's Flower-peckers, Yellow-eyed and Jungle Babblers, White-eyes, Little Minivets and Common Wood-Shrikes, to mention only the most common species. Wherever *palas* and *mhowa* trees occur, and even about habitations, Brahminy Mynahs, Bay-backed Shrikes, Large Cuckoo-Shrikes and Jerdon's Chloropsis are common, while



A GREEN BEE EATER AT THE ENTRANCE OF ITS NEST.
The tail is spread fanwise for support.

a *simal* tree, as often as not, provides a nesting site for a pair of Indian Orioles or Large Parrakeets. Here too are found the Sirkeer and a number of other species of cuckoo. It will not be out of place to remark now that *Cuculus c. canorus* arrives in this and the neighbouring districts of Chota Nagpur about the middle of April and is resident for nearly two months; that the notes—*wuck-wuck-wuckoo*, or *wuckoo-wuckoo*—of the Indian Cuckoo may also be heard throughout April and May. In spite of the most diligent searching, neither I nor my *shikaris* came across an egg which could possibly be attributed to either of these species, nor were they ever noted on the return passage. Can it be that the return migration is made by a different route?

Near the edge of heavier jungle, but outside it, the Green Barbet is found, and inside, the Common Pitta, Orange-headed Ground-Thrush, Spotted Babbler and Shama. Such jungle occurs on all the medium sized hills rising to 2,000 feet. *Nalas,* festooned with various kinds of creepers, are here frequent and provide ideal nesting-sites for three species of Flycatchers, as also an occasional Large Green-billed Malkoha. In the forest-clearings, and the bamboo jungle, I always expected to find the Large Racket-tailed Drongo but never once saw the bird. I am confident this species does not occur on Parasnath or the neighbouring hills, or in the Tundi range, as Sakroo did not know it when I showed him *Dissemurus p. grandis* in the forest at the foot of Jumra *pahar* in the Hazaribagh district, not fifty miles distant. Elsewhere throughout the Chota Nagpur division the species is common. But once again I seem to have missed my cue as I did not set out to tell of the different birds which one might expect to *see* in the Manbhum district but to describe some of my camera experiences there.

Uninteresting though it may sound, the first bird whose photograph I added to my collection in this district was the Green Bee-Eater. Numbers dig their tunnels in the low perpendicular banks beside the Grand Trunk Road down to which the paddy fields often run. Other favourite nesting sites are in the sandy banks of the valley streams, now dry in April and May. Digging operations were already considerably advanced with the pair I had under observation, sufficiently so for the birds to be right out of sight while at work. Even so it was noticeable that although only one bird at a time usually devoted itself to tunnelling, it sometimes happened that male and female were inside the passage together, when it seemed that while the one was engaged in excavating, the other employed itself in throwing out the loose earth. After working for a few minutes, always they left the tunnel together. Later, on 30 April, when the male and female Bee-Eaters were repeatedly observed flying in and out of their nest-hole with food—usually grasshoppers—in their bills, arrangements were made to photograph them at home. During the three succeeding evenings I discovered that only one bird remained overnight in the nesting tunnel, the other using the leafy twig of a mango tree hard by on which to sleep.

So gradually was the *hide* introduced that the Green Bee-Eaters paid it no attention. Successful photography was, however, an almost impossible matter owing to the way in which the birds flew straight into the tunnel without first alighting at its mouth. The result was that the exposures made the first morning merely showed a blur of movement. Accordingly, the next session saw me resort to strategy. If I hissed as the Bee-Eater was on the point of entering the tunnel, perhaps the bird would alight for a second at its mouth and give me the opportunity I wanted. The plan worked better than I dared hope, and during the next fifteen minutes I obtained two successful pictures, one a profile and the other a back view, with the head partly in the tunnel. The fan-like spread of the tail will be noted, and the manner in which the long median feathers are pressed against the bank face.

Writing of the Green Bee-Eater calls to mind the curious and tragic accidents which sometimes befall birds. While out for a walk one morning I noticed a Green Bee-Eater sally forth from its perch in pursuit of some insect. The chase led the bird round a *babool* tree and then in my direction. The next moment a grasshopper settled just where I was going to put my foot. A split-second later, the Bee-Eater, hot in pursuit, alighted at the same spot, and although my foot came down on it ever so lightly—indeed the step was never completed and the grasshopper uninjured—the little bird was killed. I suppose it was so bent on obtaining a meal—perhaps to feed its young—that it failed to realise my presence. As my *shikari*, who saw everything, remarked:—'*Sahib*, you might walk a *crore* of *kos* and such an accident not occur again.'

The Blue-tailed Bee-Eater occurs very rarely in the district—I only found its nest once, in the sandy bank of a stream—and the only other representative of the genus which I came across in these parts was the rare and handsome Blue-bearded Bee-Eater. Essentially a forest bird, this species was only met with round the Topchanchi reservoir. I am confident it breeds in the jungle here as it was heard calling every spring and up to the end of August, although it was not until 1935 that the bird was definitely seen and recognised. I was at the time photographing a Dabchick near her nest on a small piece of water between the road encircling the reservoir and the main jungle leading up to Parasnath when the unidentified call reached my ears, and looking through the *hide* spotted the author perched high up in a *simal* tree. From time to time it flew to the trunk of a dead tree where it appeared to find food in plenty. The method of calling, and the call itself, are very correctly described in the *New Fauna*[1]. The call is a deep hoarse double croak ending in a chuckle—*kok-kok-keeaou-kek-kek-kek*. At the outset it is uttered with the head held low and the long blue feathers of the throat puffed out; with each succeeding

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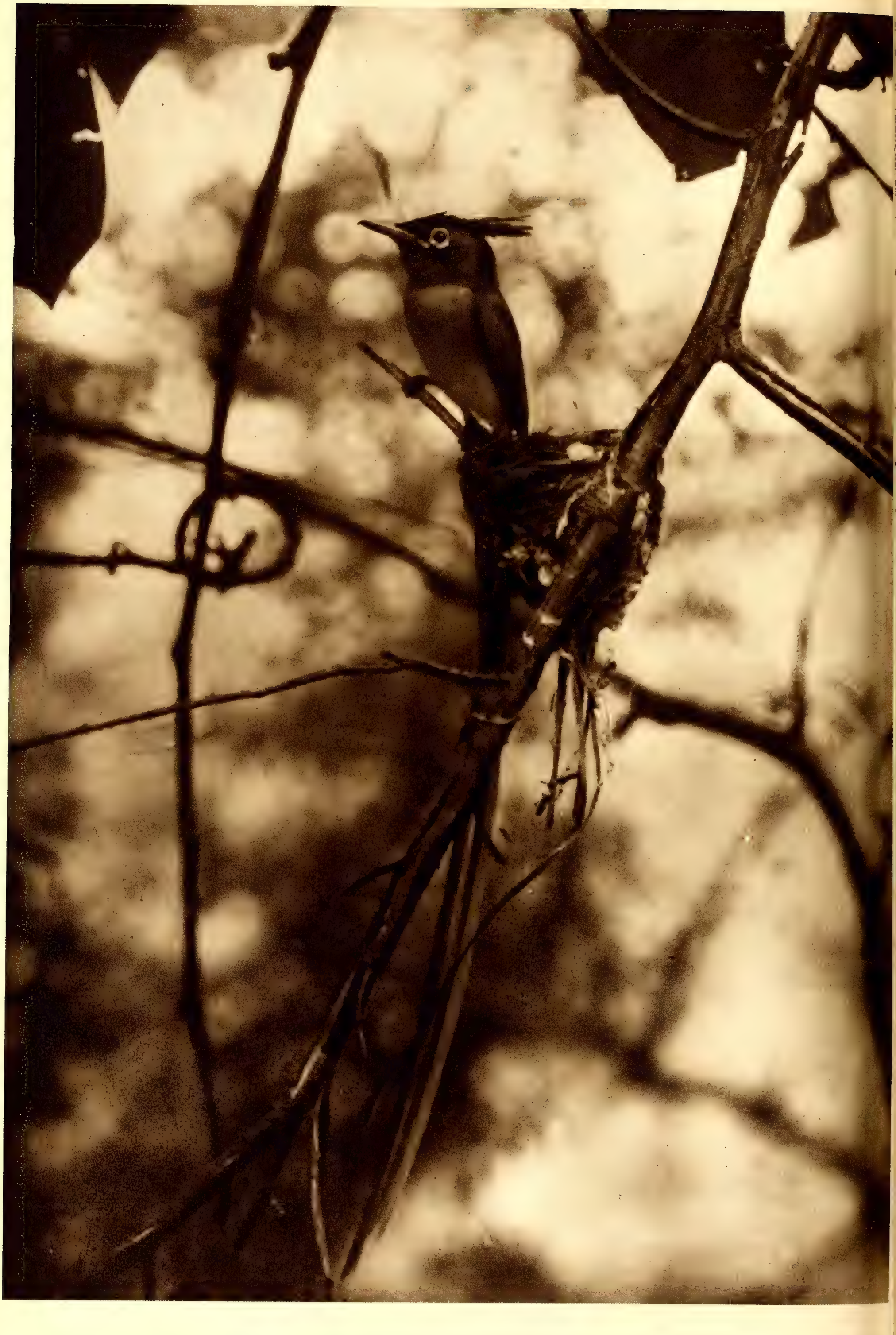
[1] Vol. iv, p. 243.



A MALE PARADISE FLYCATCHER AT NEST.
It has not yet acquired the white plumage of the fully adult male.

note the head is raised higher and higher, until finally the bird has the appearance of a crowing cock.

It is a waste of time looking for nests of the different species of Flycatchers that breed here until just before the monsoon breaks, but from about the middle of June all four—the Indian Paradise, the White-spotted Fantail, the Black-naped and Tickell's Blue Flycatchers—are busy with household duties. The second named, in these hills, as apparently also throughout the hilly regions of the Central Provinces, replaces the White-browed Fantail so commonly found in the plains of northern India. In Manbhum this last is a decidedly rare bird as I only came across it once. The Paradise and the White-spotted Fantail occur in considerable numbers, the latter frequently building its home but three or four feet from the ground, considerably lower than does the White-browed Fantail elsewhere. The Black-naped Flycatcher, a blue bird with black forehead, black top-not, and a crescent marking of similar colour on its breast, although by no means so common as the other species, cannot but be classed as occurring frequently. Tickell's Blue Flycatcher, with pinky-orange coloured breast, is only less numerous than the Paradise and White-spotted Fantail Flycatchers, but differs from the other three species in its choice of nesting quarters. The compact little nest, with skeleton leaves frequently serving as basis, is built either in a hole of a bank or more commonly of a stump of a tree or bush. All four species are a joy to watch and their quite pleasing songs may be heard by every intruder of their haunts, although, with the exception of the White-spotted Fantail, all are somewhat shy birds.

With the Paradise Flycatcher nesting so generally it was only natural that I should devote particular attention to the breeding plumage of the male bird. The male breeds even in the chestnut phase though mating must be most unusual until after his second moult when his lovely white plumage is acquired. Only once did I come across a male, with a nest, wearing the same plumage as the female. My observations showed too that although the male Paradise Flycatcher shares in the tasks of incubating the eggs and feeding the young he apparently takes no part in constructing the nest. This was also found to be the case with the Himalayan sub-species.

Blue is a most unsatisfactory colour so far as photography is concerned, and owing to the amount of blue in the plumage of the Black-naped and Tickell's Blue Flycatchers, one obtains from a print an entirely erroneous idea of the prevailing hue of these two species. Fortunately black, as a rule, is correctly rendered, so that the black markings of the Black-naped Flycatcher show up clearly in photographs. Otherwise there is nothing of particular interest to record with regard to the photography of the different Flycatchers. The fastest plates should be used as their nests are generally found in jungle where, more often than not, lighting conditions are poor; in the case of the Spotted Fantail, the employment of a large stop is usually necessary as the bird is never still for the fraction of a second.

Writing of the Black-naped Flycatcher, I am reminded of an incident which occurred when photographing this species at the nest. The nest was built on a small creeper growing over a *nala* about eight feet wide, and, after I had finished camera operations, I retired a little distance to observe more clearly the behaviour of the birds when feeding their young. While seated in the *nala*, a heavy thunder storm came on and for a space of twenty minutes or more it simply poured. Presently I heard an extraordinary sort of roar, the noise becoming louder and approaching nearer every second. I could not make out what it was. It could not have been a train as a hill nearly 2,000 feet high, and three miles of country, intervened between myself and the railway line, and it certainly was not an earthquake nor any animal with which I was familiar. However, my anxiety was soon rested when a freshet bore down on us like a baby tank. Where a few minutes before the *nala* was as dry as a bone, water three feet deep now hurled itself headlong in its haste to join some larger stream below. Pondering over the phenomenon I thought how terrifying an experience it must be to be caught by a large river in spate, or a tidal bore.

Just as when first we went to school the 'Bloods' in the xv were (and still are) in our imagination the finest 'Rugger' players we ever saw, so too perusal of the three volumes of Hume's *Nests and Eggs* even to this day conjures up visions of a wonderful team of ornithologists: Blewitt, Aitken, Brooks (also of the East Indian Railway), Scrope Doig and Major Cock, to mention only a few of Hume's great correspondents. Sandwiched in amongst these giants of a past era, working quietly and therefore liable to escape notice, but all the time using his weight, like a good forward in the 'scrum', we find occasional reference to a Captain Beavan and his discoveries in Manbhum. Was he in the Ramgarh Battalion stationed at Hazaribagh, and did he spend the hot weather on the top of Parasnath? Or was he a 'Soldier-Political' administrating the recently subdued district of the Sonthal Parganas? Who or what he was, I have never been able to learn. Memories in the East are but short-lived and I would commend to the Editors of the *Journal* the necessity for publishing, before the facts are lost in oblivion, a Bibliography or 'Who's Who' of Indian Ornithologists.

This dip into the past is occasioned by a glance through the notes detailing my finding and photographing the nests of the Tickell's and Thick-billed Flowerpeckers and Captain Beavan's records on their nidification in *Nests and Eggs*. With regard to the former Hume remarks:—'The late Captain Beavan, so far as I know, was the first person certainly to take the nest of Tickell's Flowerpecker', and from the description of the nest of the Thick-billed Flowerpecker by Captain Beavan one obtains the impression that to him falls the honour of first finding the nest of this species also.[1] Whether this was the case or not, both species still occur commonly in the Manbhum district although their nests are amongst the hardest I know of to discover. Inspite of the statement made by Stuart Baker in the *New Fauna* where, writing of the nest of Tickell's Flowerpecker, he remarks :—'In appearance and construction it is exactly like that of the other Flowerpeckers',[1] this is not the case; at all events it is unlike the Thick-billed Flowerpecker's, the only other Flowerpecker with whose nesting I have acquaintance. The nest of Tickell's Flowerpecker is *suspended from a twig* and is not unlike that of the Purple Sunbird, minus however the 'porch' over the entrance, and without the 'trailer' so common to the nest of *Leptocoma a. asiatica,* but that of the Thick-billed Flowerpecker is a bag-shaped structure, *with the roof slung along the under-side of a twig.* The materials employed in the construction of the two nests are also entirely different. Fine grass stems and a cotton-like down go largely to the making of Tickell's Flowerpecker's nest, the exterior being covered with cobwebs, cocoons, small species of bark and shavings of rotten wood, whereas the nest of the Thick-billed Flowerpecker is made mainly from the down of the *palas* flower, with spiders egg-casings worked in between, so that the whole has the appearance of being woven into one piece of felt, reddish-brown in colour.

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[1] Vol. ii, pp. 274, 277 and 278.

Most nests will be found in March or early April; numbers are destroyed by the gales prevalent at this time of year. In my experience the Thick-billed Flowerpecker lays but two eggs, of a pinky-white ground colour, with reddish-brown spots, while Tickell's Flowerpecker lays three more usually than two eggs—white and unspotted. Both select the same situations for nesting purposes, generally a twig of a mango or *seesum* tree, the nest being built at any height from ten to twenty-five or more feet from the ground. I too can bear testimony to what has been stated by several observers, that the nest of the Thick-billed Flowerpecker is often situated in the midst of the leaf-nests of that vicious creature, the large red ant; in fact I would go further and say that this is almost invariably the case.

The nest at which I photographed Tickell's Flowerpecker contained three young ones almost ready to fly. This was on 22 April and the little home was clearly feeling the strain of the extra weight, added to which a strong westerly wind rocked it as it willed. The call of the parents as we erected the *hide* was an excellent imitation of a cricket's reel, and the alarm note a sharp, piercing *utic, utic.* Neither bird showed any fear and fed the young every two or three minutes. Nevertheless photographic work was almost out of the question owing to a gale which sprang up and constantly put the nest out of focus, and the very quick movements of the birds themselves. The food given to the young was a small pill, pinkish-red in colour, probably the berry of *Loranthus longiflorus,* the mistletoe-like plant so generally parasitic on *sal* and *mhowa* trees in these parts.

Every third time they were fed one of the young always turned round and poked its vent out of the entrance, the parent either alighting on the nest to remove the excreta, or hovering with quick-beating wings and flying off with the sack as it was expelled, sometimes even helping in its expulsion, helping in the sense that the sack was seized before it had finally left the vent.

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[1] Vol. iii, p. 433.

I never succeeded in finding a nest of the Quaker Babbler but twice came across the bird on the lower slopes of Parasnath in April. Other babblers occur as residents, and, as soon as the rains break, many nests of the Spotted Babbler are to be found just inside the jungle surrounding the Jharia Water Board's reservoir. They are always built on gently-sloping ground which, at this season, is covered with a deep carpet of leaves. The nest itself is a globular ball of dead leaves, about the size of a fairly large melon, and usually is scantily lined with the fine stems of the maidenhair fern. Three eggs form the full clutch. The bird is shy and a great skulker but has a most attractive call, a clear whistle, *wheat-ee-er,* and a loud note, *chunk-chunk-chunk,* which give away its whereabouts. Going down hill it is a simple matter to tread on the nest but if one works the ground in an upward direction the nest is easily seen owing to the bulge it makes in the general contour, and because the entrance always looks down hill. I am afraid many eggs of this species are eaten by snakes which abound in these parts. Here the Spotted Babbler breeds most commonly at an elevation of only 950 feet. It is not a difficult bird to photograph, the only interesting feature about the one I portrayed being that it was minus the outside toe of the left foot.

Discussion of the Spotted Babbler reminds me of the difficulty Sakroo and I always had in talking of the different species: he had no names for most birds and it was useless telling him the English names. We therefore invented names. The Spotted Babbler came to be known as *patti chiriya,* the 'Leaf bird', in allusion to its nest. Similarly the Orange-headed Ground-Thrush was referred to as *chupki,* the 'Silent one', the Sirkeer as *neora chiriya,* from its resemblance to a mongoose when running along the ground, and so on through the gamut; which is a better method of each understanding the other than the one my devoted first *shikari,* Pokhi, tried to adopt. He was with me in Kashmir in 1931 when we met Lala Sheikh, Mr. B. B. Osmaston's old *shikari.* Lala was well acquainted with the English names of birds and aired his knowledge at every turn. This was too much for Pokhi who determined that in future he would always speak of a bird by its English name. Alas! the first one he tried his hand on, or rather his tongue, was Hume's Willow-Warbler. I explained who Hume was and he repeated the name a dozen times till he thought he had it pat—but his rendering of it, *'Hume sahib que Billow-Bobbler',* brought a smile to my face and Pokhi thereafter decided our made-up names were good enough for him.

The Rufous-bellied Babbler is quite as common a breeding species in these parts as the Spotted Babbler, but to my mind the former's nest is far more difficult to find; in its breeding habits too the species is interesting from more than one point of view. To begin with, the nests are of two different types,

THE SPOTTED BABBLER.
The nest is a globular ball of dead leaves.

either an oval ball of dead bamboo leaves lying on its side, with the entrance at the end, or more commonly a ball of coarse grass with the entrance about half way up the side. Whatever the material employed, the nest is usually situated only a few inches from the ground, although I once saw one about four feet up in a bush, and another quite six feet—both unusually high. The nest may be built either among grass and weeds surrounding a small bush on the outskirts of jungle, or a little way in the jungle, but all those I have seen had this common feature, they were always built alongside a path of sorts. Many have no lining but others a slight one of what appears to be hairs but which close inspection reveals to be fine maidenhair fern stems. Then again, the breeding season is prolonged and commences a fortnight or more before that of the Spotted Babbler, and continues till the middle of September, as I see from my notes that both in 1934 and the following year I examined nests containing young on the 12th of that month. Four is the largest number of eggs I have seen in a nest. These have a white ground with the slightest shade of red, with reddish-brown spots and blotches.

The Rufous-bellied Babbler, like the Spotted Babbler, is a great skulker, but if one remains motionless in its haunts, the bird may be studied at ease. Once I observed a pair, apparently males, fighting. They were seated on a horizontal twig, facing each other. One put its head down, utterred a challenging note, threw its head up and advanced a step towards the other. His opponent went through exactly the same performance, and both repeated it until finally they met, flying at each other—a confused mass of feathers—and eventually separated. This was on 30 June and possibly the birds were disputing territory. On another occasion I watched a party of quite twelve Rufous-bellied Babblers rummaging under a mass of dead leaves. At times none of them were to be seen, though the leaves showed movement. Had I first come across them feeding in this manner, invisible, it is quite probable I would have imagined the movements of the leaves were caused by a snake and have hit out with my *khud* stick. The party spirit is most noticeable in this small species which is well termed Rufous-bellied. The male (who is the more brightly coloured) possesses quite a pleasant song of which I wrote in the following terms while listening to it—'The first half very like a red-winged bush-lark's, and the latter part resembling the canary-like notes of the sunbird, the two running into each other without a break'.

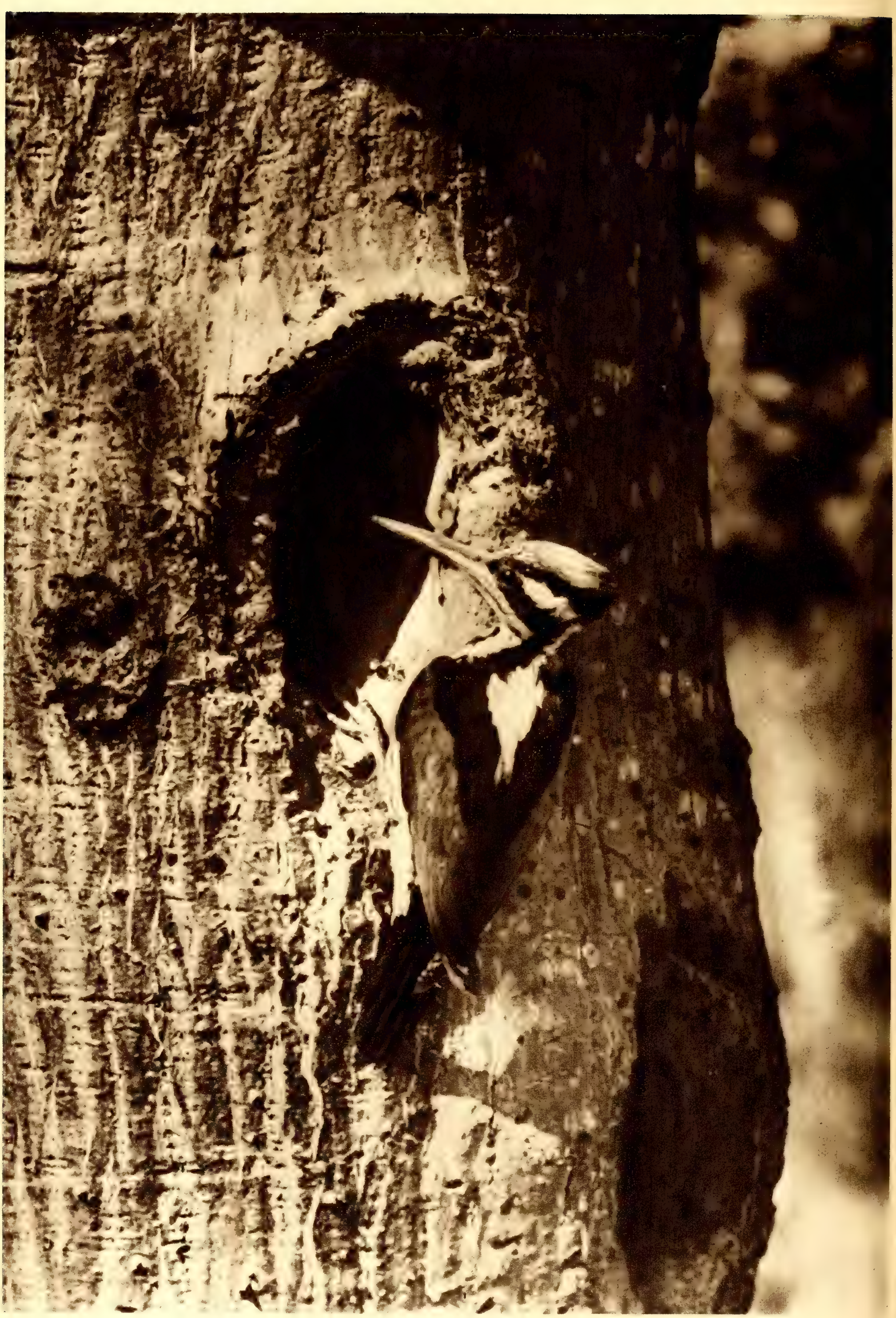
I never came across the Large Grey Babbler in Manbhum. Other babblers which occur in the district are the Jungle, the Common, and Yellow-eyed Babbler, the first and last named being found in considerable numbers but the Common Babbler less generally. Of the Yellow-eyed Babbler it can truthfully be said that there is nothing about the bird which does not at once please; the ruddy-chestnut upper plumage, long tail and chaste lower parts, the blood-orange eyelids, its acrobatic ways as it climbs up or down some reed stem, the sweet song, beautiful nest and lovely eggs, all combine to make the Yellow-eyed Babbler a most attractive bird to meet. A week or so after the monsoon breaks, as soon as the scrub jungle affords better concealment, one can confidently look for its nest and continue to do so till August and even early September. Five eggs are usually laid, pinky-white in ground colour, thickly marked all over with chestnut-red; more rarely they are sparingly but boldly marked with the same colouring.

The Green and Blossom-headed Parrakeets commence nesting operations early in the year and their eggs may be found regularly from about the beginning of February till the end of March or even later. The Green Parrakeet usually makes use of a natural hole in a tree for nesting purposes, or one previously occupied by a woodpecker or barbet. It rarely cuts one out itself, whereas the Blossom-headed species almost invariably cuts out its own hole. The former favours holes in mango trees; the latter is partial to the *mhowa*, its nest hole generally being cut in the large 'knots' about the size of a man's head, which are a feature of this tree. The Large Indian Parrakeet starts to nest even earlier—or is it *later?*—and its eggs may be found fairly regularly throughout December. The earliest record I have of this species is 20 November when I examined a nest containing three eggs. This is the usual number in a clutch although I have occasionally found four. The Green Parrakeet *normally* lays four, and the Blossom-headed species *commonly* five eggs. The Large Alexandrine Parrakeet differs from the others in that it almost invariably nests in natural holes of the red silk cotton tree, and always at great heights from the ground. The word nest is really a misnomer when applied to the *Psittaci* as the eggs of all of the genus are laid on the bare floor of the hole made or selected, no attempt being made at furnishing. In these parts I never came across a nest in a hole of a building or wall, though elsewhere in northern India such sites are regularly used by *Psittacula krameri manillensis.*

All three species have fallen victims to my camera but there is little in the behaviour of one to distinguish it from the others when at the nest. Both sexes incubate and feed the young, though in the case of the Large Indian Parrakeet these tasks devolve more largely on the female. All feed their young by regurgitation, but while *P. eupatria nepalensis* and *P. c. cyanocephala* approach the nesting tree quietly and usually at long intervals, the Green Parrakeet seems to feed the young more frequently and often gives notice of its coming. The food given by all three species must I think, usually be the fruit of the wild fig, judging by the visits of the birds to such trees. There can be little doubt that the small berries inside the unripe *mhowa* flower also form a considerable item on the *mènu.*

What a gorgeous sight the *mhowa* presents at this season with its fresh green foliage; the deep mauve coloured flowers of the orchid so commonly parasitical on this tree also add greatly to the joy. How over-powering though the smell of the fruit!

The small woodpecker common in the Manbhum district is the Yellow-fronted Pied species, *mahrattensis.* The Golden-backed



THE BLACK-BACKED WOODPECKER.

Outside its collar-shaped nest hole.

Woodpecker is decidedly scarce, its place being taken by the Black-backed Woodpecker, a somewhat larger and equally handsome species. This frequents the outer fringes of mixed jungle and is found particularly about the lower slopes of small hills. For a nesting tree the *simal* is a great favourite, and often the same tree is resorted to year after year, a fresh hole only being cut higher up the trunk and a little to the side of the previous one. This is not circular in form as is usual with the *Picidae* but somewhat horse-collar shaped. The species is an early breeder and the egg may be found from about 10 January onwards, or even earlier, as on the 25th of that month in 1934 a nest I examined contained a young one whose wing feathers were already beginning to grow. Altogether six nests came under my inspection and not in one instance did these contain more than a single egg or young one.

The different text books tell us that the Rufous Woodpecker occurs generally in Chota Nagpur. Accordingly I hoped to meet the species in the district and looked forward keenly to studying this very interesting bird at its equally interesting nest, constructed inside the *papier-mâché*-like blackish-grey nest of a tree ant, with which it seems to live on the most friendly terms. Alas ! I never came across either the bird or its nest in Manbhum or elsewhere in the Chota Nagpur division.

A number of small ravines, heavily forested, mainly with bamboo growth, run down from the hills to the Topchanchi reservoir on all sides except the north-east, and afford sufficient cover for possibly half a dozen pairs of Shamas. I was enthralled when I listened early one morning to the lovely notes of this fine songster. I had never before heard them, and although I felt sure the Shama was the author, my curiosity was not to be satisfied that morning, nor was it until some days later that I actually saw the accomplished artist perform. Now I wanted to find its nest, and, if possible, to photograph the bird at home, though the prospect of doing so seemed hopeless, such a forest and shade-loving species is the Shama. To cut matters short, I wasted two seasons looking in the wrong sort of place for the nest. Whatever the Shama may do elsewhere, in the Manbhum district it builds its nest *only* in holes of trees or stumps, not more than five or six feet from the ground, and never, I think, amongst the collection of dead leaves found at the foot of every clump of bamboos. The nest is rather an untidy affair, with a basis (sometimes quite substantial) of dead leaves, and has a lining of fine roots. Here the bird does not begin to nest until after the rains have set in, the earliest (and first) note I have of a nest being 25 June when I found one containing five fresh eggs. It is more usual to find nests with eggs at the beginning of July. The breeding season is short and the young have flown by the middle of August at the latest. Five is an unusual clutch and my experience coincides with that stated in *Nidification of Birds*, that four is the normal number of eggs laid.[1] These are much the same in size as those of the Magpie-Robin, to which, of course, the Shama is closely related. There is also in the colour and markings of the eggs of the two species a close family resemblance, those of the Shama, however, possessing more of a green than a blue ground. Like the Spotted Babbler and the Orange-headed Ground-Thrush, the Shama nests usually at an elevation of only 950 feet. Higher than 1,000 feet I never found its nest.

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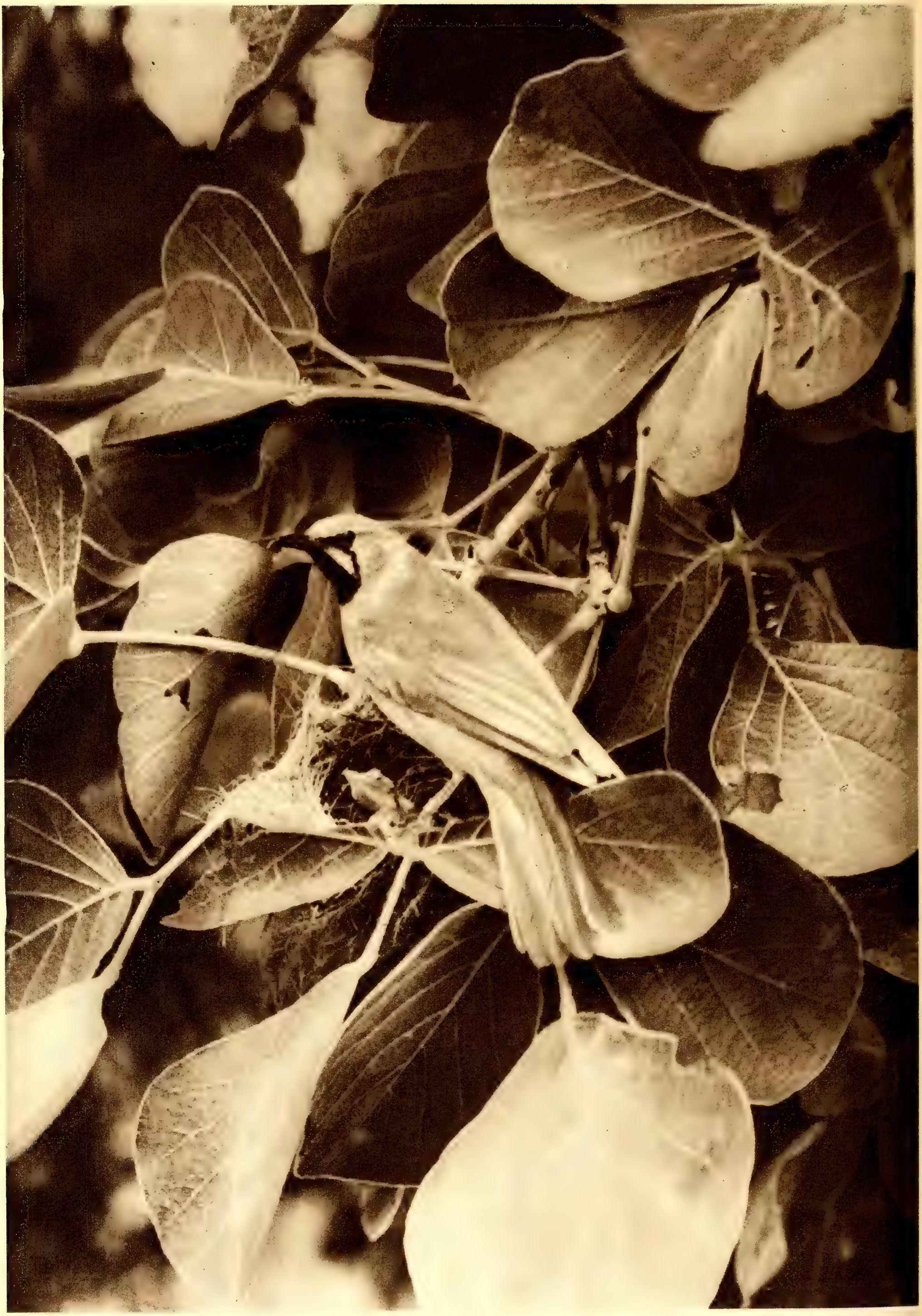
[1] Vol. ii, p. 106.

There is no difficulty in photographing the Shama at the nest as it is very confiding, but owing to the very poor lighting conditions that invariably exist at the nest, I wasted nearly fifty plates before I obtained a picture that bears reproduction at all. The female is clad in sombre plumage but the male handsomely clothed; nevertheless he is just as difficult to pick up in the jungle as is his mate.

The Iora breeds commonly in the scrub jungle proper, and where scattered *palas* and *sal* trees occur, the Little Minivet, Large Cuckoo-Shrike, Jerdon's Chloropsis, the Sirkeer, and Spotted Dove. The Common Pitta occasionally nests in similar country but more usually it breeds in mixed deciduous forest. By making its beautiful nest so generally in low bushes,—often in close proximity to the Yellow-eyed Babbler—the Iora earns the photographer's everlasting gratitude.

Reading through my notes written when photographing the Iora, I am reminded of a matter not generally realised, how young birds quickly succumb from even a comparatively short exposure to the sun's fierce rays, exactly as they do if deprived of the parent's warmth and protection when it rains heavily. Although both sexes incubate and feed the young most assiduously, I noticed the female Iora only, during the first five days of their lives, brooding her young for about ten minutes every third time she fed them, her wings out-stretched, to shield them from our old friend—and enemy too, in the East—*Sol.* Clearly she was aware of the sun's danger to the young. I have noticed the same anxiety shown by the Painted Stork, King Crow and a female Chestnut Bittern.

The Little Minivet is most partial to the *palas* tree for nesting purposes. The nest harmonises closely with its surroundings and looks just like a knot in a branch. It would usually escape detection but for the parents flying to and from a particular tree, obviously to feed the young, or taking material to build their charming little home. What a handsome creature is the male with his beautiful grey upper plumage, flame-coloured rump and breast, his long tail and a wing-patch similarly coloured, and his bluish-grey chin and throat! The female, with her yellow plumage, and generally paler colouring than her consort's, is a 'good-looker' as well. At one nest which I 'worked', the female always flew away with the white sack-like excreta of the young held in her bill; the male, on the other hand, almost invariably ate this while still near the nest.



JERDON'S CHLOROPSIS (Male).
The cobweb covered nest is suspended between the stems of two leaves.

Jerdon's Chloropsis, or the Malabar Green-winged Chloropsis, as Mr. Stuart Baker would now have us call this delightful bird, is exceedingly common in Manbhum, even frequenting gardens in Dhanbad itself, where owing to its powers of mimicry, it frequently deceived me into thinking a shikra had paid me a visit. More usually it is met with in the scrub, and about *palas* and *mhowa* trees round hamlets near the jungle. Its cheerful notes take some learning, and owing to its bright green colouring it is not a species which can easily be detected while perched in a tree. Nevertheless, though few colliery managers know Jerdon's Chloropsis by sight, there is not a local savage who is not well acquainted with the *hara* (green) *bulbul*, as the bird is usually called. About seven inches in length, the sexes are alike in general colouring, but whereas the male has a purple chin and a streak of the same colour from the eye to the base of the throat, the female has these parts greenish-blue. Like others of its genus, Jerdon's Chloropsis is entirely arboreal in its habits. The nesting season is prolonged. I have found nests containing eggs in March and again in the early part of September, and in every month in between. The nest, a fairly deep cup, is constructed of very fine roots, covered on the outside with cobwebs and vegetable fibres, and suspended hammock-like between the stems of two leaves. It is always placed at the extreme end of a *palas* bough, and usually at a height of between 20′ and 30′ from the ground. I must have examined quite forty nests and not in one single instance were they other than as described. Two is the full number of eggs in a clutch.

One other representative of this genus is found in Manbhum but is uncommon—the Gold-fronted Chloropsis. In the thicker scrub and mixed jungle of the Dolkata *nala* leading up to Parasnath, I once came across a nest of this species early in July containing two eggs.

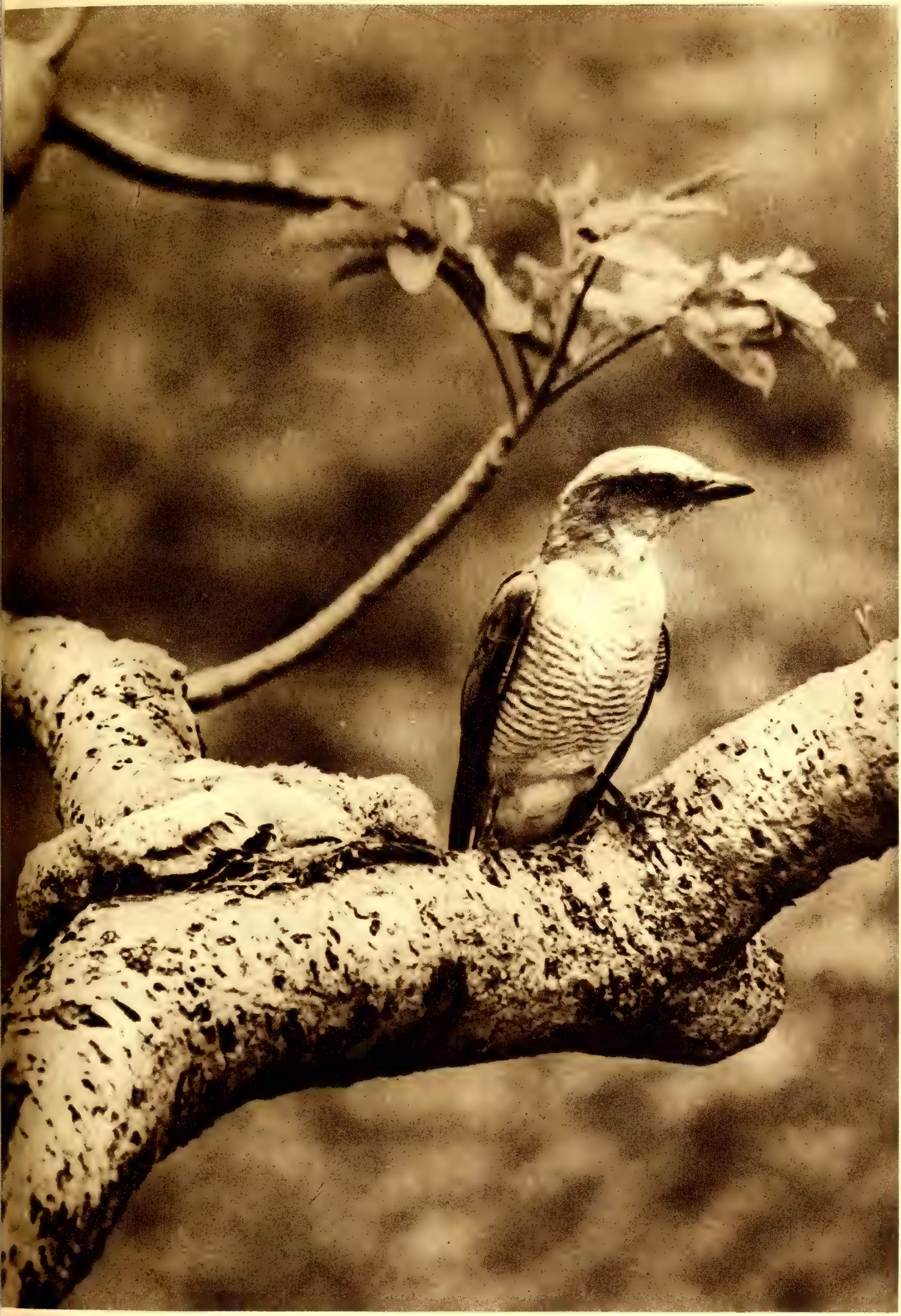
One of the noisiest birds I know of—I do not include the Jungle Babbler which is in a class by itself—is the Large Indian Cuckoo-Shrike. Always as it utters its loud shrieking call I feel that the bird has been given a sharp and unexpected nip or pinch by some exuberant neighbour! Keeping much to the tops of *mhowa* and *nim* trees bordering on cultivated land, and to *simal, gharnim* and *sal* trees where the scrub jungle adjoins deciduous forest, this Cuckoo-Shrike continually utters its loud parrakeet-like call. About the size of a dove, this species is mostly grey in colour, darker on the upper than the lower parts, which are almost white, and closely barred about the breast. The nest too is generally built in these same trees, but whereas in the United Provinces the few I found were quite substantial saucer-shaped structures, in Manbhum they were invariably flimsily built affairs, always placed on some horizontal branch where it forked. The nest is decidedly small for the size of the bird, about five inches in width at the outside, and a little over an inch in depth. I have no note of a nest containing more than two eggs or young. The egg is a yellowish-buff in ground colour and is well blotched with chocolate-brown markings distributed evenly over the surface. The breeding season commences about the third week in March and continues till the middle of July.

The photograph of the Large Cuckoo-Shrike rather gives the impression that the young have come to the end of their tether and will soon pass out. In a sense this was the case but was caused, not by prolonged exposure owing to the parents being afraid to return to the nest, but by the young having a surfeit of a mixed caterpillar diet! A charming feature about this species when courting is the manner in which it lifts and shakes each wing alternately over the back, calling as it does so.

From about the beginning of March till the end of September the Indian Oriole occurs commonly throughout the district. It is partial to gardens and mango *topes*. The Black-headed Oriole, however, which is resident throughout the year and, comparatively speaking, scarce, is far shyer and spends its life in more remote regions, on the forest's edge and even inside the jungle. Yet, since a bird will always refute you if it can, I have known *O. xanthornus* also build its nest in a garden! Both species possess the most delightful liquid calls, as also a horrid rasping note; both build nests identical in every respect, placed between slender horizontal twigs at the end of a branch, usually between 20′ and 30′ from the ground. The Black-headed Oriole however, sometimes makes its nest quite low down when this is built in jungle, not more than eight or ten feet from the ground. A description of the nest here is unnecessary as not only is it familiar to most people but elsewhere it has been so well described. The number of eggs in a nest varies from two to three in the case of the Black-headed Oriole and between two and four where *Oriolus o. kundoo* is concerned, though in Kashmir I once found a nest containing five eggs.

Neither Oriole is easy to approach with the camera and unless the *machan* is very gradually built and its construction spread over a period of a week or longer, the chances are the birds will desert the nest. The young, at first, are fed on gnats and other minute insects, and later, on small caterpillars, and in early infancy are the blondest things imaginable.

Thick scrub jungle, interspersed with much *palas* and *sal* growth, is a feature of the country side in the hilly parts of the Manbhum district. Here it is that the Sirkeer-Cuckoo is often enough to be found, though few people I know were aware of the bird's occurrence until they had spent a day with me shooting Jungle-Fowl. More than once, when the beat was over, I was asked 'What was the brown-looking bird with a long tail and red and yellow bill which came out a few minutes ago, perched on a *sal*, and then sneaked off?' I am sure my interrogator's credulity was taxed to the utmost when I told him it is a species of cuckoo and that it builds a nest instead of laying its eggs in the nests of other birds, as is the case with the 'Harbinger of Spring' at home, and my *bête noir* out here, the Koel.



A LARGE INDIAN CUCKOO SHRIKE.

A surfeit of caterpillars explains the grievous depression of the chicks.

In spite of the Sirkeer occurring fairly commonly I have found few nests myself, though I have seen many others, thanks to the agency of Sakroo. Nearly all those I have examined were built in the uppermost branches of pollarded *palas* and *sal* trees, where the dense foilage made detection difficut. The nest is a fairly substantial platform of twigs, with a lining of green leaves, usually of the tree in which the nest is built. The eggs, which are two or three in number, are pure white when first laid and average 1.40 inches in length by 1.05 inches in breadth. In the Manbhum district the breeding season extends from the end of April till the end of September, on the 29th of which month I have seen a nest containing three well incubated eggs.

I have tried very hard to photograph the Sirkeer at the nest but have never come anywhere near success, and in view of my experiences have long since abandoned all efforts in this direction. The bird will at once desert if the nest contains eggs. I regret to say such has also been the case when there have been young, this in spite of my having superintended personally the erection of the *machan* and being satisfied that more than ordinary precautions were taken not to disturb the birds.

The Sirkeer is normally very silent, but, when alarmed, utters a guttural *khokh-khokh*, quickly repeated.

As long ago as 1862, Jerdon either stated the Large Himalayan Green-billed Malkoha occurs or breeds in Chota Nagpur and the Northen Circars, or he thought it did—I am not sure which, as my copy of 'Jerdon' was lent a few years ago to a friend who failed to return it. But no ornithologist since appears to have met with this species in these parts, judging by what Blanford's *Fauna*, the *New Fauna* and *Nidification of Birds* have to say in the matter. The first named quotes Jerdon in support of the Large Green-billed Malkoha occurring in Chota Nagpur, but adds:—'This needs confirmation',[1] while in the *New Fauna* Mr. Stuart Baker observes —'possibly Chota Napgur and Northern Circars (Jerdon)',[2] a statement which is repeated in *Nidification of Birds*, the relevant volume of which was published in 1934.[3] It would therefore appear that in spite of the passage of seventy-seven years Jerdon's remarks still await confirmation today (1939). Jerdon was, however, quite correct. It is surprising that the species has not been noted from Chota Nagpur in recent years, as it is not only fairly common (for an unusual bird) in Manbhum, in the heavy mixed forest round the Topchanchi reservoir and the Dolkata *nala*, but is found in the neighbouring district of Hazaribagh. It is, however, a particularly shy species and frequents forests the European seldom invades, which fact probably accounts for it having remained unnoticed so long. A hasty glimpse of the bird—and this is all that is vouchsafed one as a rule—gives the impression of a very large male koel—it is about twenty-three inches in length, more than half of which is accounted for by the tail. At close quarters, however, the apple-green bill, with a tinge of red about the base, and the bare crimson orbital patch, as also the ashy-green colouring about the head, neck and chin, are noticeable. Sceptics may imagine I am mistaken in my identity and that what I saw was the Small Green-billed Malkoha. Such is not the case. Although I have not come across *Rhopodytes viridirostris,* it is not possible to confuse the two species. The Small Malkoha is not only considerably smaller (about 15½″ in length) but has the orbital patch cobalt-blue and the throat feathers forked, which is not the case with *Rhopodytes t. tristis.*

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[1] Vol. iii, p. 232. [2] Vol. iv, p. 178. [3] Vol. iii, p. 361.

In the Manbhum district the Large Green-billed Malkoha nests during July and August in heavy jungle, amongst creepers, at a height of between 15′ and 20′ from the ground. I have found eggs as early as 14 July and as late as 8 August. The nest is made of twigs and roots and is lined with green leaves, but is not such a substantial structure as that of the Sirkeer which, however, it closely resembles. The three nests I found each contained three eggs. These are a chalky-white in colour and average 1.46 × 1.05 inches in size.

Although so shy when not breeding the Large Green-billed Malkoha sits closely once incubation has commenced. On several occasions, when I climbed on to the *machan* to photograph this bird, the Malkoha remained on the nest though I was on a level with and in full sight of the bird and but ten feet away. It was only when Sakroo or Pokhi came up as well, to pack me up, that the bird's courage failed. Always as she flew, she uttered a note very similar to that of the Sirkeer.

When I started photographing the Large Green-billed Malkoha on 29 July, an atmospheric depression seemed to have settled over the land and though I took a number of photos on three different days, the weather continued dull till eventually the deluge came, and with it floods, fever and misery for everybody. With the elements conspiring against me and the nesting site being in such a dark place, the resultant negatives are very thin, and it is only due to heavy intensification that a print is possible at all. Nevertheless, I value the Malkoha photographs more highly than many of my more successful efforts with other birds. Of course, when the rain subsided the sun came out in all his glory, but, alas ! the Malkoha's eggs had disappeared and my *machan* been pulled down. I learnt subsequently this was done under instructions from a sub-overseer, whom I had recently reported for permitting promiscuous poaching and fishing, and cutting of grass and timber, his idea being that if he spoilt my nests I would not patronise those parts and he and his satellites would then be able to pursue their nefarious activities unchecked.

In these parts the White-breasted Kingfisher breeds commonly in the sides of *nalas* running through the scrub jungle, towards the base of the lower hills, though it also resorts for the same purpose to the banks of small streams running through open country. Nesting tunnels are frequent too where the hill sides have been cut away to make the road running round the Topchanchi reservoir. I looked forward to finding the rare and abnormal type of nest resembling 'a large, untidy edition of an English Wren's place of abode' first recorded many years ago by Stuart Baker and referred to in *Nests and Eggs*[1], but never happened on one, though I have heard of similar nests of this kingfisher being seen in the Jamalpur hills, in the Monghyr district. The nesting season is prolonged, from April till September, but most nests will be found in June and July. This species, as is well known, is more given to feeding on insects than on fish. The pair I photographed near their nest frequently brought grasshoppers wherewith to feed the young, including a large species almost the size of a locust, which occurs commonly on the thick-leafed mauve and white flowered *Calotropis* plant said to possess medicinal properties. Dragon-flies were also occasionally brought, and on an average of once in every twelve visits, a small fish. The 'shivering' scream of this species as it sits on some tree is a familiar sound. Occasionally the bird indulges in 'stunts'. I once watched *Halcyon smyrnensis fusca* mount high into the skies, flying over the forest in increasingly wider circles till it was almost out of sight, screaming all the while, and then dive obliquely over a distance of a quarter of a mile or more in the direction of an open river. While diving the bird was absolutely silent. This was on 7 May.

The Common Indian Kingfisher occurs far less usually than does the preceding species, but the Pied Kingfisher is common, its nesting operations commencing early in January. The Brown-headed Stork-billed Kingfisher is decidedly scarce. I came across only two nests of this species, in successive years, one containing three fresh eggs and the other four young. The contents of both nests were taken by Manjis before I could attempt photography. The former was found on 31 May and the nest containing young on 10 July.

I was surprised to meet the Orange-headed Ground-Thrush in the district. It occurs only as a summer visitor and is intensely local in its distribution, being confined to one particular area round the Topchanchi reservoir where, however, quite a dozen pairs breed every year. Nesting commences with the advent of the monsoon and is completed by the middle of August, as is the case with the Shama. Normally a silent species, the male possesses a pleasing song heard usually in the early morning. Though reputed to mimic the calls of other species I never heard him attempt this. I have, however, heard the alarm note which has very aptly been likened to the screeching noise produced by a pencil on a slate, but unless one sees the bird one would never connect this note with the Orange-headed Ground-Thrush, so quickly and stealthily does the bird make itself scarce when its haunts are invaded. The male is most handsome, with his bluish-grey upper parts and orange-chestnut head, neck and lower parts; the female is a dull *replica* of the male.

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[1] Vol. iii, p. 17.

This Ground-Thrush, like many of the other species dealt with here, is a forest-loving bird, and spends its life in jungle where there is plenty of undergrowth, under which it seeks industriously for what it may find to eat, whether vegetable or animal. The nest, which does not appear to be placed higher than 10′ from the ground and is built either in a bush, or more usually in the fork of a tree, is not unlike a small edition of a blackbird's nest at Home. It is made of grass stalks and coarse grass, some moss, and lined with maidenhair fern stems and roots, with a fair amount of mud worked into the foundations in some cases but entirely lacking at other times. Both sexes help in building the nest and incubating the eggs, which usually number four; once only I found as many as five. These are very handsome and have a bluish-green ground with (usually) heavy brown-yellowish-red splotches and freckles spread over the entire surface.

A shy species, the Orange-headed Ground-Thrush nevertheless does not object to a hiding tent being introduced near its nest. Though a ready sitter, the bird is an unsatisfactory subject from the photographer's point of view owing to its colour responding poorly even to a panchromatic plate.

Pea-to-yew, a loud, clear and far-reaching note which I had not heard previously, repeated again and again. So close was the bird and obviously calling from a point of vantage; yet it was some considerable time before I spotted the performer. The trouble was I was looking too near. When finally the Zeiss Delactis glasses revealed the bird, perched high up in a *simal* tree, near the trunk, I was struck by the method of calling: head and shoulders thrown right back, chest out, and the bill pointing to the skies, just as a cock crows. This is the normal manner of calling though the bird also occasionally calls from the ground. Having recently acquired the album of *Common Indian Birds* published by the Bombay Natural History Society, depicting a a number of species in colour, I had no difficulty in at once identifying the cock-crowing author. It was the Common Indian Pitta, surely one of the most beautiful birds found in the Peninsula. Whistler's description cannot be improved upon. He says:—'Length 7 inches, sexes alike. Top of head pale fulvous, with a broad black band down the centre which is joined by a very broad black band from below the eye; a narrow white line over the eye; back and shoulders green; lower rump shining pale blue; tail black, tipped with dull blue; wing black with a conspicuous white patch in the flight-feathers, and with the coverts green and blue; chin and throat white; remainder of lower plumage fulvous, a patch of bright scarlet under the tail.'[1] No wonder the Indian knows the Pitta as *nao-ranghi*, the 'Nine-coloured one'. Like the Orange-headed Ground-Thrush, this species is only a hot weather visitor to these parts; all have left the Chota Nagpur division by the middle of September. Nevertheless, during its stay the Pitta occurs commonly and it is amusing to watch the bird when it is apprehensive of everything not being quite as it should: the short tail is then flitted up and down after the manner of a moorhen.

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[1] *Popular Handbook of Indian Birds*, 2nd edition, p. 241.

Whistler, probably from thinking of others of the genus at the time, has fallen into the error of stating that the majority of nests of the Common Indian Pitta are placed on the ground or in low branches close to it.[1] This is most emphatically not the case. All the nests I have seen—quite fifty in number—were built in trees, close to the trunk, at heights varying from 12′ to 25′ from the ground. The nest, shaped rather like a rugby football lying on its side, often has the top one-third end sliced off, so that the bird has a *chubutra* or platform from which to approach the nest proper. Four, five and even six eggs are laid, very spherical in shape and measuring approximately 1.00 × .86 inches. These have a lovely china-white ground colour sparingly marked with purple spots and speckles. At times the nest is built in the most exposed of situations, giving the impression that it is a broken-down structure which has yet stood the acid test—storms, wind and the *loo*. More usually it is fairly well concealed in *palas* and *sal* trees, occupying much the same situation as the Sirkeer's nest. It is made of sticks and twigs, with leaves worked in between, is domed, with the entrance at one side, and lined with roots and dead leaves. The breeding season extends from the end of May to the end of July.

Somebody once asked me if I knew the 'Ginger-beer' bird: obviously this species, and an excellent rendering of the Pitta's call.

Not even the most imaginative writer could describe the Pitta as interesting when at the nest. It usually dashes straight in to feed the young, which done it stands on the *chubutra* for minutes at a stretch, looking as though it did not quite know what it had done or was now expected to do. This is not surprising really when it is added that mole-crickets are a favourite dish on the *menu*, a great delicacy which if used with a snare will inevitably bring about a bird's capture. To provide such a *pièce de résistance* all the time to their young must be a sore trial even to fond parents!

I cannot conclude this article without making mention of a great discovery by my wife, in Dhanbad itself, of the breeding of a bird concerning which I hope at some future date to write more fully. I refer to the Whiskered Tern. My wife had been playing golf early one morning and when she burst in on me while I was still shaving it was clear that she had something important to tell. My thoughts at once turned to *birdies* and *eagles*, but it was nothing so prosaic she wished to discuss. She had seen some birds which looked like small gulls, fly with grass or weeds in their bills and then alight on the Baker *bund*, a fair-sized tank less than a quarter of a mile distant from our bungalow, and on the road to the club. It did not take me long to investigate matters for myself. Many of the Whiskered Terns were still building; others were on eggs. The nests were in the middle of the *bund*, where the water was deepest, and all on a narrow path of weeds which stretched across from north to south. Later, I counted sixty-three occupied nests here. My enquiries showed that the Whiskered Tern had never previously nested on this piece of water, nor did it do so again during 1934, 1935, 1936 or 1937, this inspite of the fact that, almost without exception, each pair successfully reared and took away its young. At first I was at a loss to explain this but on examining the position more carefully the reason was at once apparent. The narrow strip of weeds which formed the foundation for the nests in 1933 had been cut down at the roots, so that no suitable nesting sites existed. Later, during the same year, I found three more nesting colonies of this species in the district, all approximating in size to the original one discovered by my wife.

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[1] *Popular Handbook of Indian Birds*, 2nd edition, p. 242.

Early in 1935 Mr. Prater wrote telling me that Manbhum is a very important district ornithologically, that many original descriptions were made of birds collected in this area, but that a modern collection of birds from the district was necessary to clear up many points: would I undertake this work? I was unable to do so for several reasons but I believe it will be obvious to anyone who has had the patience to read through this article that Manbhum is indeed fortunate in the wealth and variety of its bird-life, particularly when it is remembered that this is really confined to a very limited part of the district. The *avifauna,* however, needs protection and I would urge everybody interested in the subject, everybody who has any authority locally, whether on the District Board, the Jharia Water Board, or Societies for the Protection of Wild Life in the province, to do all in their power to make the country around the Topchanchi reservoir a bird sanctuary. It lends itself to being easily adapted as such. Many will at once rise up and tell me that this is already the case. My reply is 'Don't you believe it. *Experto crede'*—not that I am expert at anything but I do claim that I know better than others what goes on daily round this reservoir and its catchment area.

In order to give a better idea of the ornithological possibilities of the district, I quote below a list of the different species whose nests I found in Manbhum; I am confident it is capable of many additions.

Jungle Crow, House Crow, Indian Tree Pie, Jungle Babbler, Common Babbler, Rufous-bellied Babbler, Yellow-eyed Babbler, Spotted Babbler, Common Iora, Jerdon's Chloropsis, Gold-fronted Chloropsis, Red-vented Bulbul, Brown-backed Robin, Magpie-Robin, Shama, Orange-headed Ground-Thrush, Tickell's Blue Flycatcher, Paradise Flycatcher, Black-naped Flycatcher, White-spotted Fantail Flycatcher, Bay-backed Shrike, Common Wood-Shrike, Little Minivet, Large Cuckoo-Shrike, King Crow, White-bellied Drongo, Tailor-bird, Streaked Fantail-Warbler, Ashy Wren-Warbler, Indian Wren-Warbler, Jungle Wren-Warbler, Indian Oriole, Black-headed Oriole, Brahminy Mynah, Common Mynah, Pied Mynah, Baya Weaver-Bird, White-throated Munia, White-backed Munia, Spotted Munia, Yellow-throated Sparrow, House-Sparrow, Wire-tailed Swallow, Red-rumped Swallow, Large Pied Wagtail, Indian

Pipit, Red-winged Bush-Lark, Ashy-crowned Finch-Lark, White Eye, Purple Sunbird, Tickell's Flowerpecker, Thick-billed Flowerpecker, Common Indian Pitta, Black-backed Woodpecker, Mahratta Pied Woodpecker, Golden-backed Woodpecker, Crimson-breasted Barbet, Green Barbet, Indian Roller, Green Bee-Eater, Blue-tailed Bee-eater, Pied Kingfisher, Common Small Kingfisher, Brown-headed Stork-billed Kingfisher, White-breasted Kingfisher, Northern Grey Hornbill, Hoopoe, Indian Swift, Palm Swift, Indian Crested Swift, Common Indian Nightjar, Jungle Nightjar, Franklin's Nightjar, Long-tailed Nightjar, Pied Crested Cuckoo (in Jungle Babbler's nest), Koel (in House Crow's nest), Sirkeer, Large Green-billed Malkoha, Crow-Pheasant, Large Indian Parrakeet, Green Parrakeet, Blossom-headed Parrakeet, Rock Horned Owl, Collared Scops Owl, Spotted Owlet, Jungle Owlet, King Vulture, White-backed Vulture, Small Scavanger Vulture, Bonelli's Eagle, Lesser Spotted Eagle, Brahminy Kite, Common Kite, Shikra, Lugger Falcon, Common Green Pigeon, Rufous Turtle-Dove, Spotted Dove, Little Brown-Dove, Indian Ring Dove, Red Turtle-Dove, Common Peafowl, Red Jungle-Fowl, Painted Spur-Fowl, Jungle Bush-Quail, Black Partridge, Grey Partridge, Common Bustard Quail, White-breasted Waterhen, Moorhen, Stone-Plover, Bronze-winged Jacana, Pheasant-tailed Jacana, Red-wattled Lapwing, Yellow-wattled Lapwing, Whiskered Tern, Little Cormorant, White-necked Stork, Little Egret, Cattle Egret, Pond-Heron, Night Heron, Chestnut Bittern, Little Grebe. Total 124 species.

SOME COMMON INDIAN HERBS WITH NOTES ON THEIR ANATOMICAL CHARACTERS.

BY

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Prof. of Botany, Osmania University, Hyderabad Deccan.

(*With three plates*).

(*Continued from page* 323 *of this volume*).

III.—ANDROGRAPHIS ECHIOIDES Nees.

(ACANTHACEAE).

SYNONYMY AND SYSTEMATIC DESCRIPTION.

Andrographis echioides Nees in Wall. Pl. As. Rar. iii, 117; DC. Prodr. xi, 518; H. F. B. I., iv, 505; Cooke. Fl. Bomb. Pres., Vol. ii, Pt. II, 374; Dalz. & Gibs. Bomb. Fl., 198; Trim. Fl. Ceyl., Vol. iii, 327. Syn :—*Justicia echioides* Linn.; Burm. Fl. Ind., 9; Roxb. Fl. Ind., i, 118; Grah. Cat., 164.

An erect herb, average height about 12 in., densely clothed with white hairs; stem quadrangular, grooved. Leaves sessile, decussate, entire, oblong, margins ciliated, base cuneate. Flowers in axillary racemes about as long as the leaves. Calyx glandular-hairy, divided almost to the base, sepals linear, ciliated, elongating in fruit. Corolla pink or white, densely pubescent, 2-lipped, lower lip 3-lobed, blotched with purple. Anthers much exserted, white-bearded; pollen-grains blackish and oblong when dry, and pale-yellow and spherical when moistened. Capsule hairy, elliptic-lanceolate, acute at both ends, compressed. Seeds rugose, glabrous, not compressed.

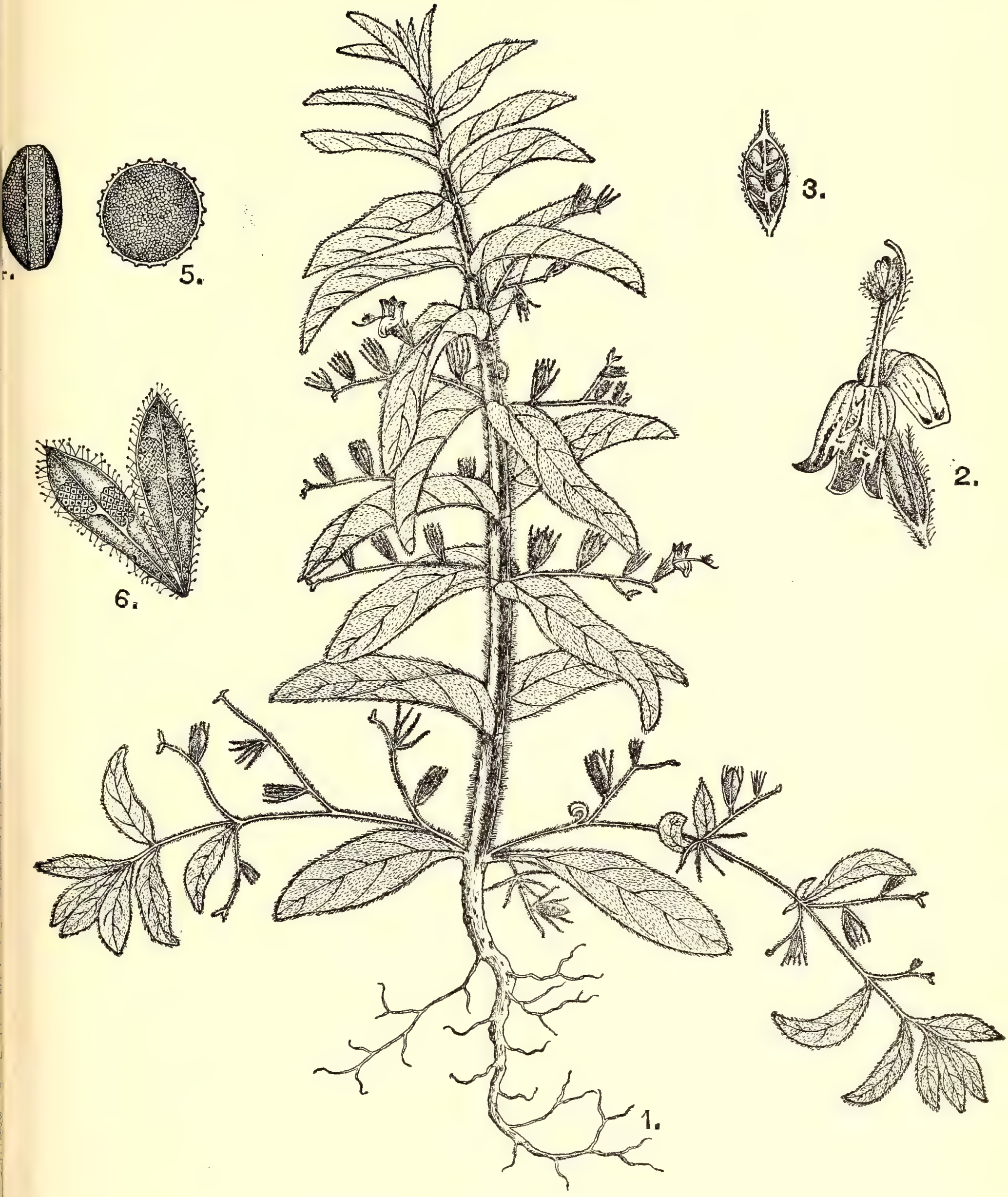
Flowers :—August—October. Medicinal (Kirtikar, 4) (Pl. I & Pl. II, Fig. 1).

INDIAN NAMES.

Ran Chimani (Deccani); Peetumba (Malay).

HABITAT.

Common in the drier districts from the Punjab and Chota Nagpur to Ceylon; absent from Bengal proper and humid Malabar; not very common in Bombay Presidency (Dalzell and Gibson, 2),



Sayeedud-Din—Common Indian Herbs.
Andrographis echioides Nees. (×½)

For explanation see end of article.

common in the Madras Presidency (Mayuranathan, 5); very common in Hyderabad Deccan (Sayeedud-Din, 6).

ANATOMICAL NOTES.

Structure of the leaf (Plate II, Fig. 2 and Plate III, Fig. 1). The leaf-structure is bifacial. Stomata occur on both sides of the leaf, but are more numerous on the lower. They are of the Caryophyllaceous type, the pairs of guard-cells being accompanied by two subsidiary cells, which are placed transversely to the pore.

Oxalate of lime is present in the form of small prismatic crystals. In the leaf it is found in all parts of the mesophyll and also in the epidermis. In the stem it is present mostly in the pith and the primary cortex.

Besides the occurrence of oxalate of lime, cystoliths are present in the epidermis of the leaf, and a few in that of the herbaceous stem (Plate II, Fig. 2 and Plate III, Fig. 1). They occur singly and are elongated with more or less blunt extremities, although a few are pointed at one end. Solereder (7) mentions that round cystoliths occur in the Andrographideae, and in rare cases transitions to elongated forms with blunt extremities are found.

The hairy covering (Plate III, Figs. 2—7) consists of ordinary clothing hairs and glandular hairs. The clothing hairs are unicellular or uniseriate. Glandular hairs are of two kinds. Those occurring on the stem and leaves are in surface view disc-shaped, and composed of four or more cells separated by vertical walls. The glandular hairs on the calyx and corolla consist of a uniseriate stalk terminating in a glandular spherical head.

Structure of the Stem. Stem and branches are quadrangular in section. Stomata are present. Epidermal cells are rather large. There is no hypodermis. The primary cortex contains collenchymatous cells. An endodermis is present.

CONCLUSIONS.

The study of this plant reveals the following main features which are generally characteristic of the family Acanthaceae. (1) Caryophylleous type of stomata; (2) excretion of oxalate of lime in the form of prismatic crystals; (3) occurrence of elongated cystoliths with blunt extremities (this does not apply to all the members of this family, for there are some genera in which cystoliths are not present, and there are others in which round cystoliths occur); (4) The clothing hairs are unicellular or uniseriate; (5) The glandular hairs on the vegetative portions are disc-shaped and multicellular with vertical walls. Those on the floral parts consist of a long uniseriate stalk terminating in a spherical head.

Besides other features the occurrence of typical cystoliths (with the exception of those members which do not possess these structures) distinguishes Acanthaceae from the allied families Verbenaceae and Labiatae. The shape of cystoliths and their place of occurrence in the leaf can be employed in detailed classification within the family Acanthaceae.

ACKNOWLEDGMENTS.

I am thankful to Mr. Sri Ram Loo for the photographs and the drawings which were prepared under my supervision, and to Messrs. Fateh Nasib Khan and Riazul-Hasan Qurieshi for the preparation of several slides.

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EXPLANATION OF PLATES I TO III.

Illustrating M. Sayeedud-Din's paper on 'Some Common Indian Herbs with notes on their Anatomical Characters'.

III. *Andrographis echioides* Nees.

PLATE I.

Fig. 1.—Black and white sketch of *Andrographis echioides* Nees. ($\times\frac{1}{2}$).
Fig. 2.—A single flower with corolla opened out to show the bearded anthers. (×5).
Fig. 3.—L. S. Ovary. (×5).
Fig. 4.—Pollen grain, showing the shape in dry condition. (×240).
Fig. 5.—Pollen grain, showing the shape in moist condition. (×240).
Fig. 6.—Fruit split open to show the rugose seeds. (×5).

PLATE II.

Fig. 1.—Photograph of *Andrographis echioides* Nees.
Fig. 2.—Photo-micrograph of leaf-epidermis, showing elongated cystoliths and a glandular hair. (×96).

PLATE III.

Fig. 1.—Leaf-epidermis, showing cystoliths, stomata and a glandular hair. (×480).
Figs. 2 & 3.—Glandular hairs on the vegetative parts in T. S. (×480).
Figs. 4 & 5.—Clothing hairs on stem and leaves. (×480).
Fig. 6.—Clothing hair on the floral parts. (×480).
Fig. 7.—Elongated glandular hair on calyx and corolla. (×96).

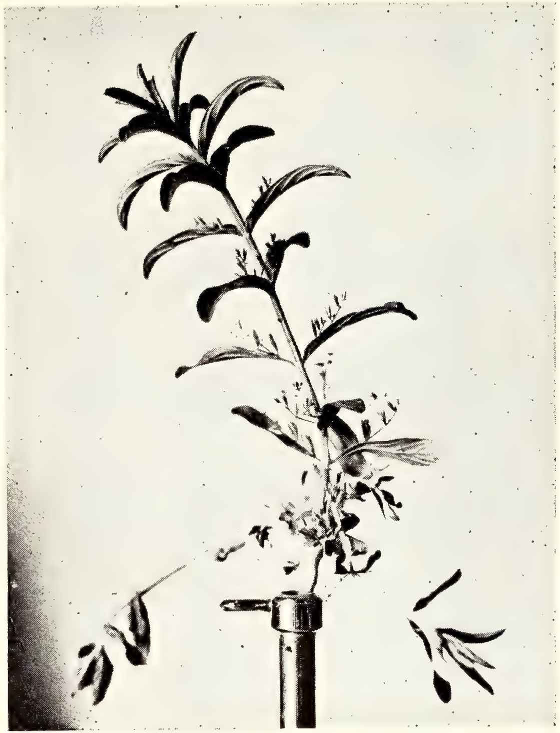


Fig. 1.

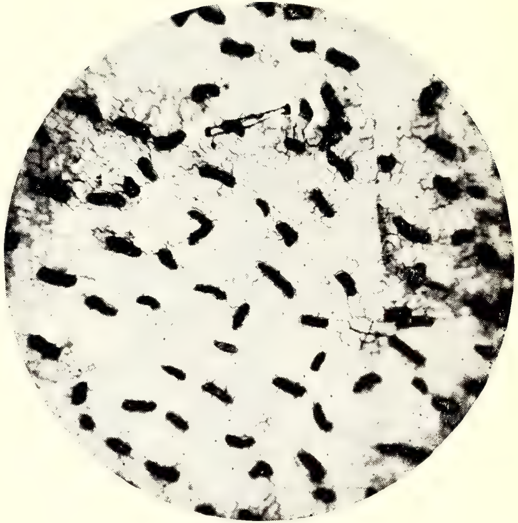
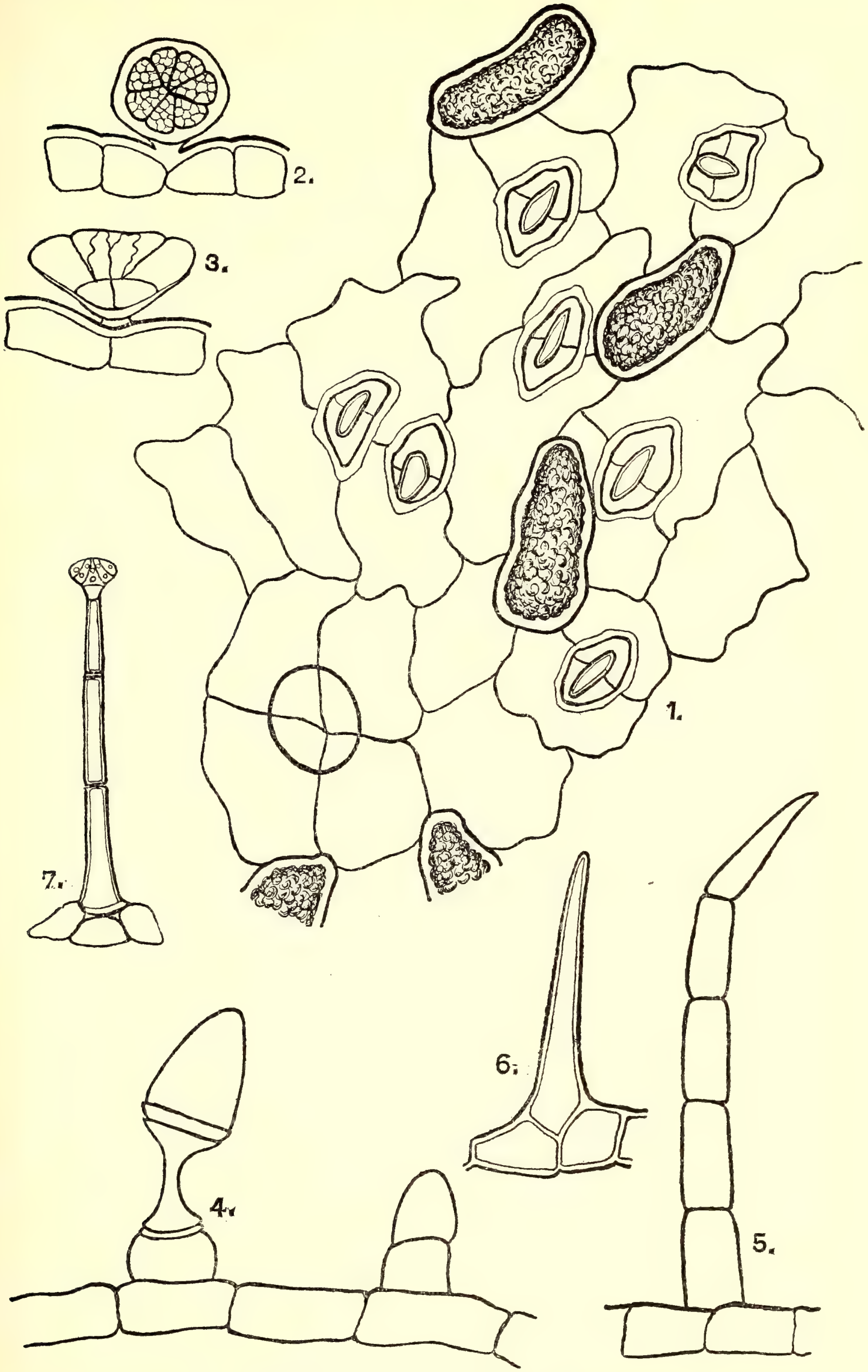


Fig. 2.

Sayeedud-Din—Common Indian Herbs.

For explanation see end of article.



Sayeedud-Din—Common Indian Herbs.

For explanation see end of article.

FISH LADDERS IN THE PUNJAB.

BY

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(*With a map and two plates*).

Most of the common game and food fishes of the Province belong to the *Cyprinidae* (Carps), *Siluridae* (Cat-fishes), or *Ophiocephalidae* (Murrel). The Murrel are not migratory and breed in tanks, ponds and stagnant waters in April and May (Hamid Khan, 1924). A large number of the Carp and the Cat Fishes on the other hand show a tendency to migrate to a greater or lesser extent.

The Mahsir, one of the Carps, is by far the most important migratory species of all the fresh water fishes of India. It is a well known game and food fish. In summer as soon as the streams are swollen by the monsoon rains the Mahsir 'are able to ascend to parts of the river till then unapproachable for want of water. There they find fresh feeding grounds that are inaccessible to them at other times. There they deposit their spawn and thus secure for their fry when hatched, waters, then dwindled to dimensions much better suited to their puny strength than the deeper current of the lower river' (Thomas, 1897).

Most of the other Cyprinidae, too, such as Rohu (*Labeo rohita*), Morakha (*Cirrhina mrigala*), Theila (*Catla catla*) as well as some Siluridae, namely Bachwa (*Pseudeutropius garua*), Khagga (*Rita rita*) and others ascend the rivers during the monsoon rains in search of suitable spawning grounds and after laying their eggs in shallow waters return to the main stream (Hamid Khan, 1924).

It is, therefore, evident that for the propagation of the species of almost all the game and food fishes of the Punjab proper facilities are needed to enable them to ascend the rivers so as to reach such waters as will suit them to lay their spawn.

With the development of irrigation projects in the Punjab, dams or weirs have been constructed in the form of masonry works at the Headworks of the canals for the purpose of deflecting water into the canals. The weirs (Fig. 2) run across the entire width of the river and thus obstruct both the upward and the downward passage of fish. In order to enable the fish to ascend the head waters of the rivers and thus reach their spawning grounds for propagation, or to follow their migratory habits in search of food, fish passes or fish ladders (Fig. 3) have been provided in the weirs.

Weirs have been erected across the following rivers in the Punjab (Fig. 1).

1. River Jumna (near *Tajewala*).
2. River Sutlej (at *Ropar, Ferozepore, Suleimanki, Islam* and *Panjnad*).
3. River Ravi (at *Balloki, Madhopur* and *Sidhnai*).
4. River Chenab (at *Marala, Khanki* and *Trimmu*).
5. River Jhelum (at *Mangla* and *Rasul*).

Fish ladders have at present been provided by the Irrigation Department on all the weirs except at *Tajewala, Mangla* and *Sidhnai.* Most of the ladders have been in existence for over fifty years or so, but so far hardly any serious attention has been paid to ascertain their proper functioning. A survey of most of the fish ladders was made by the author and the outdoor Fisheries Staff in 1937-38, and as a result of it an attempt has been made in this paper to discuss the working of the ladders and to draw attention to such among them as are either not successful or only very moderately so.

WEIR AND ITS STRUCTURE.

Day, as early as 1873, described in detail the structure of a weir as having 'openings of varying sizes, termed undersluices, constructed for the purpose of permitting the surplus water passing through the body of the weir and on a level with the lowest bed of the river. These undersluices are kept shut except when there is an excess of water in the rivers, as during the monsoon months.' They close by means of iron shutters which can be elevated, when it is desired to do so, by capstan and windlass (Figs. 3 and 4). These narrow undersluices carry such a rush of water through them that no Indian fish can ascend the river when they are open (Fig. 2). Day (1873) recommended as one of the remedies to prevent injury to fisheries 'that every irrigation weir spanning a river have a practicable fish pass in it.' Dunsford (1911) drew the attention of the Punjab Government to the erection of fish passes and suggested certain principles which should be accepted for guidance. In 1916 the Department of Fisheries, Punjab, issued a Bulletin on 'Notes on Fish Ladders,' and recommended the 'Improved Cail Fish Pass' for the Punjab.[1]

Different Systems of Fish Passes. 'The underlying principle in the construction of fishways is the retardation of the current velocity of a waterfall so as to enable fish to surmount it.' (Bayer, 1908). In America and on the Continent innumerable devices with that object in view have been invented and proved more or less successful.

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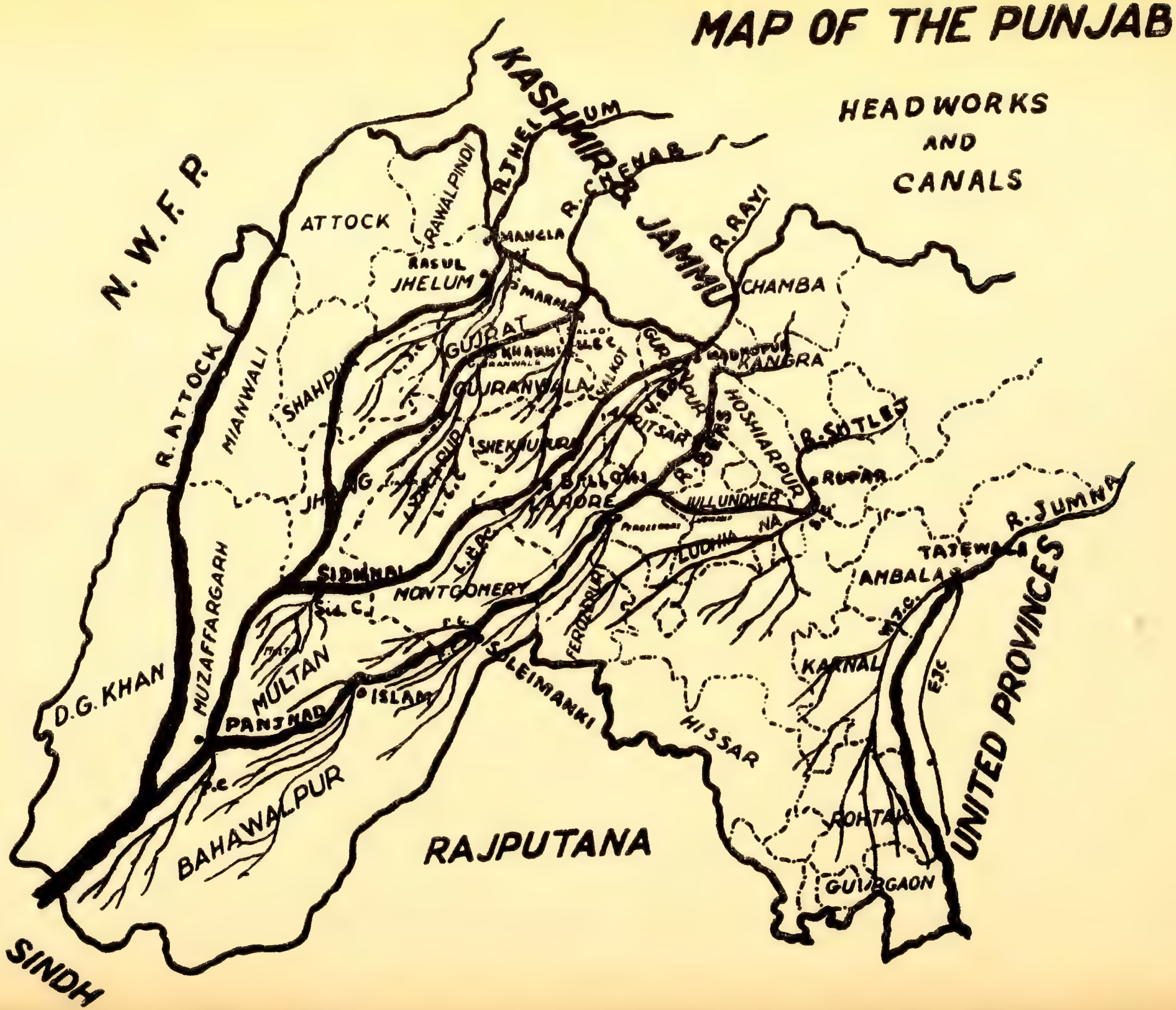
[1] The Cail Fish Pass was originally invented by Cail, an Engineer in New Castle, and improved upon by B. M. Hoecht, a German designer (Calderwood 1926). It was not invented by a German designer as is stated in the Bulletin No. 1 of the Department of Fisheries, Punjab, 1916. The Bulletin is out of print now.


MAP OF THE PUNJAB
HEADWORKS
AND
CANALS
N.W.F.P.
KASHMIR
R. JHELUM
R. CHENAB
JAMMU
R. RAVI
CHAMBA
ATTOCK
RAWALPINDI
MANGLA
RASUL
JHELUM
MARALA
GUJRAT
GUJRANWALA
SIALKOT
GURDASPUR
MADHOPUR
KANGRA
HOSHIARPUR
R. SUTLEJ
R. BEAS
AMRITSAR
SHEKHUPURA
LAHORE
BALLOKI
JULLUNDHER
RUPAR
LUDHIANA
FEROZEPUR
SULEIMANKI
ISLAM
MONTGOMERY
L.B.C.
SIDHNAI
MULTAN
PANJNAD
BAHAWALPUR
MUZAFFARGARH
D.G. KHAN
R. ATTOCK
MIANWALI
SHAHPUR
JHANG
LYALLPUR
L.C.C.
L.J.C.
U.J.C.
W.J.C.
E.J.C.
TAJEWALA
R. JUMNA
AMBALA
KARNAL
HISSAR
ROHTAK
GURGAON
UNITED PROVINCES
RAJPUTANA
SINDH

Hamid Khan.—FISH LADDERS OF THE PUNJAB.

Bayer (1908) and Calderwood (1926) classify the fishways into four systems according to their style of construction:

1. *The Inclined Plane System,* in which the checks are so arranged that the descending water takes a zigzag course, being driven from side to side by an alternating arrangement of the breaks or baffle walls. Fish are, therefore, forced to take a sinuous course as they ascend.
2. *The Pool or Fall or Step System,* in which the water is brought down to a lower level by a series of short falls with intervening pools. This type of pass was invented by Cail, an Engineer in New Castle. Baffle walls were placed right across the width of the pass so as to form partitions. These were pierced by apertures large enough to allow a fish to pass, but not large enough to allow all the water in the pass to get through. Portion of the water flowed over the tops of the partitions too.[1]
3. *The Counter Current System,* in which the descending volume of water is checked by meeting a current opposing it at certain intervals. This pass was devised by McDonald (1882).
4. *Lock and Gate System,* in which a higher or lower level is reached through one or more locks operated by gates.

The systems 3 and 4 above are so complicated that they are practically very little in use now.

MAIN REQUIREMENTS OF A FISH LADDER.

Although every fish ladder, to a certain degree, has to be adapted to meet the special conditions of the locality, yet there are some general principles in all the four systems which may be accepted for guidance.

1. The slope of a fish ladder should not be steeper than one foot vertical to ten feet horizontal, so as to ensure a current of a velocity not exceeding ten feet per second in any portion of the fishway. The flow of the water should be gentle and without deep falls.
2. As regards the dimensions of the fish ladder, both the available volume of water and the size of the fish have to be considered. Since in the Punjab it is to be used by small fish such as Chilwa (*Aspidoparia morar*), not exceeding five or six inches in length, as well as by big fish such as Mahsir (*Barbus tor*), Rohu (*Labeo rohita*), Morakha (*Cirrhina mrigala*) and others which vary from one to three feet or even more in length, the falls should

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[1] The Cail Fishway was improved by a German designer Hoecht. 'The improved Cail Fishway' is a combination of the inclined plane system with the pool and fall or step system. It consists of a series of compartments arranged in steps, and separated by a number of cross partitions, which are provided with suitable orifices at the bottom alternating successively from side to side so as to allow the fish according to their individual habits to ascend the fishway by either leaping over the small waterfalls over the cross partitions or by darting through the orifices, at the same time enabling them to rest in the compartments in comparatively still water.

average from eight to twelve inches and the width of each compartment should not be less than ten feet. 'The compartment or bays of the pass must be of such dimensions that the fish do not risk collision with the sides and upper end of each bay when ascending' (Dunsford, 1911).

3. 'Plenty of light should be admitted in a fishway, both for maintaining therein the natural conditions of the water, and in order that the interior may easily be inspected and any foreign matter removed' (Bayer, 1908). 'There must be nothing in the formation of the pass to suggest the existence of a trap' (Dunsford, 1911).

4. 'It should in all its parts, by action of the current of water passing through it, be as nearly as possible self cleaning of all sand, gravel and rubbish' (Bayer, 1908).

5. The water supply should be ample and there should always be water in the ladders in the season when the fish are making the ascent.

6. 'The top and side of a fishway should be above ordinary highwater' (Bayer, 1908).

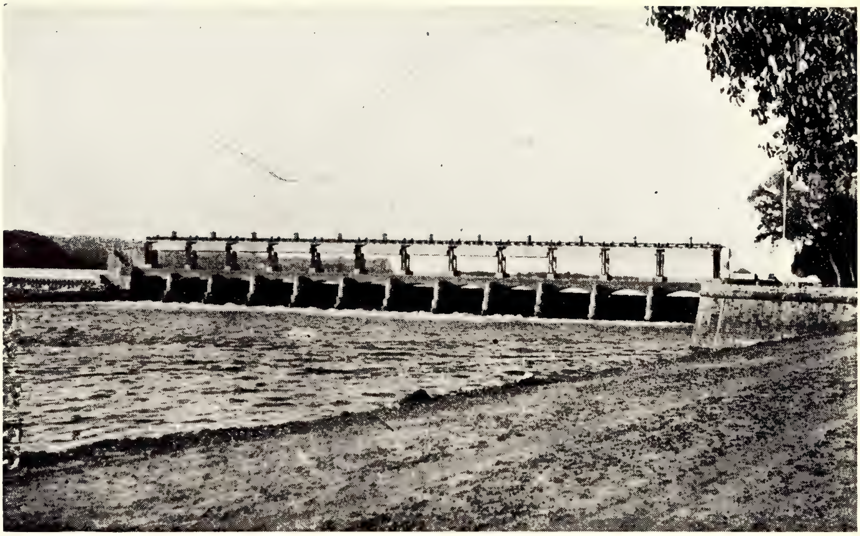
7. 'The pass must be situated where it will be self advertising; i.e. it must form a current impinging into a certain place below the obstacle so strongly that it becomes the chief or predominant current of the stream, when the fish will be led to that point for attempting the ascent' (Dunsford, 1911). 'One may have the best possible kind of pass, but if fish do not get into it one may as well have no pass at all. The position of the entrance is of paramount importance no matter what type of pass is selected. The ideal position for the entrance to the pass is close to where the fish lie, so that there will be an attractive flow of water from the pass, when the river is at the level at which they chiefly run' (Calderwood, 1926). The entrance should be located in a pool at the bottom of the ladder where fish would naturally collect before ascending the river, and these pools must be kept clear of all silt and other accumulations and deposits.

In the light of the knowledge gained from the descriptions of the various styles of fish passes existing in other countries, one may examine the fish passes constructed on the Headworks of the Canals in the Punjab.

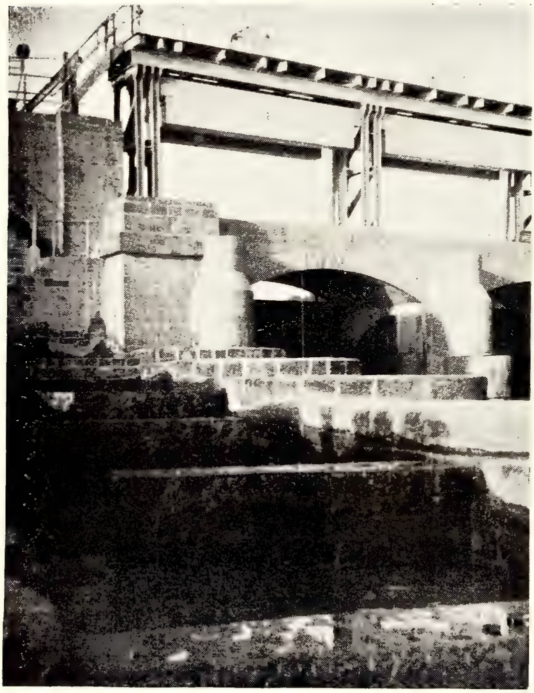
I am indebted to the Executive Engineers, Irrigation Department, Punjab, for providing me with facilities for the inspection of fish ladders and for furnishing me details of their design and construction.

RIVER JUMNA.

Tajewala Headworks. Tajewala, on the River Jumna, 25 miles from Jagadhari, is an old Headworks (constructed mainly between 1870 and 1880), where two canals, the Eastern Jumna Canal supplying the United Provinces, and the Western Jumna Canal going to Delhi and Hissar, take their origin shortly below the point of exit of this river from the hills. At Tajewala the river is furnished with gates for regulating the supply of water



Weir across River Sutlej at Rupar Headworks.



Fish ladder at Rupar.

to the canals. For full nine months of the year the gates are closed and not a drop of water passes down the river, and consequently the upward passage of all the fish in the river below the gates is totally obstructed. There is no fish ladder at the Headworks. It is only during the rains when surplus water is available that the weir and sluices are open to let the water into the main stream. At such time the velocity of the current through the undersluices prevents the fish from ascending upstream.

For more than fifty years the fish in the River Jumna, especially the Mahsir, have been deprived of the opportunity of ascending the hilly tracts in search of their spawning grounds. Mahsir begins to ascend the rivers in April and May and its passage is obstructed by the weir at Tajewala. Towards the end of September the fish in the upper reaches of the river above the weir begin to fall down the stream with the diminishing volume of water after the monsoon floods. At about the same time the sluices and the weir shutters at the Tajewala Head are completely closed and no water escapes into the river. The returning fish consequently pass into the canals. Once the fish have passed into the canals they have absolutely no chance to return to the river, as at Dadupur twelve miles down the Western Jumna Canal there is a rapid of 180 feet length, with a fall of about 15 feet, and it seems almost impossible for any fish to climb the rapid. Such fish are doomed to die and are caught during the canal closure.

A fish ladder at Tajewala is very badly needed, but at the same time it is very essential that it should not be a fish ladder only in name but should be made to work during the months when the fish are on the move. At Dadupur a system of steps and falls might be provided to break the velocity of the current without dismantling any of the existing engineering works.

RIVER SUTLEJ.

Rupar. The weir (Plate I) across the River Sutlej at Rupar for deflection of water into the Sirhind Canal was constructed in 1882 and the fish ladder on the left side of it (Fig. 3) was also built in the same year. Its cost is not available in the records. It had originally fourteen bays. The first bay near the entrance measures 25 feet by 12 feet, the second 33 feet by 10 feet, and the remaining ones 10 feet by 10 feet. An additional bay was added to it at its upstream end and the downstream cross walls were raised by 1·5 feet, and the side walls by 2 feet during 1914-15, at an approximate cost of Rs. 950. The difference between the bed of the river upstream and downstream end of the left side ladder fish ladder (Plate I) in the right flank of the weir was built in 1921 at a cost of Rs. 3,432. It had 10 bays to begin with. During 1926-27 another compartment 7.5 feet by 9 feet was added, and beyond this a counter sunk trough was made for low winter supplies. To reduce the fall and help the Chilwas (*Aspidoparia morar*) to climb the ladder easily, the last two compartments were split up into four at a cost of Rs. 788. The remaining compartments were also provided with cross walls in 1927-28 at a cost of Rs. 708. In the right side ladder there is a difference of about 9·51 feet between the levels at the downstream and upstream. The flow of water in both the ladders is regulated by means of wooden kurries fixed in the baffle walls. The width of the inlet, and outlet and the openings of the baffle walls is two feet. On the 11th April 1937 the right hand side fish ladder was found to contain two Mullies (*Wallago attu*), two Bachwas (*Pseudeutropius garua*) and one young Mahsir. The fish ladder on the left side, on the same day, was found to have one dozen Mahsir, and a dozen Bachwas, which were found to be ripe. One female Bachwa yielded eggs on slight pressure. The walls of the fish ladder, however, are too low and become flooded when the ladder is running full.

Ferozepore. The Bikaner Canal, the Eastern Canal and Depalpur Canal take their waters from the River Sutlej at Ferozepore weir which was completed in 1929. The fish ladder was originally constructed in 1927 at a cost of Rs. 98,623 and extended in 1929 at a cost of Rs. 15,591.

The fish ladder consists of 18 bays with incomplete baffle walls. The dimensions of the bays are 3 feet by 4 feet with a fall of about 6 inches in each. There is only one fish ladder and the flow of water in the bays is controlled by cement kurries. On the 17th April 1937 the ladder was seen full of Chilwas (*Aspidoparia morar*), young Bhangan (*Labeo micropthalmus*). Big fish such as Mahsir, Rohu, Morakha and others were not met with, but it is said that they move up the ladder, when the head of water on the upstream of the ladder increases and the ladder is running full.

Suleimanki. The Sadiqia, the Fordwah and the Pakpattan Canals take their waters from the River Sutlej at Suleimanki. The weir, and both the right and left side fish ladders were constructed in 1926. The cost of each fish ladder was Rs. 59,000 approximately. The right fish ladder has 24 bays with incomplete walls, out of these 18 bays measure 12 feet by 9 feet each. The first compartment is 19·6 feet by 9 feet; and from the 19th to the 24th measure 7·5 feet by 5 feet. Previously the fish ladder had one long slope as in the *inclined plane system*, and the force of the current when water was run was too strong for fish to ascend. Subsequently, in 1931-32, the floor of each bay was raised at a total cost of Rs. 6,715 to make a fall of 6 inches. The total length of the ladder is 308 feet. The upstream bed of ladder is R.L. 560·9 and the downstream bed R.L. 543·6, the difference being 17·3 feet. The slope is 1 in 15 per compartment in the first 18 compartments, and 1 in 5·6 per compartment in the last six. The dimensions of the openings in the baffle walls are 2 feet, and of the inlet and outlet 3 feet. The water level in the ladder is controlled by kurries. On the 16th April 1937, the right fish ladder was seen to contain Chilwa (*Aspidoparia morar*), Jhalli (*Eutropiichthys vacha*), Rohu (*Labeo rohita*), Kalahan (*Labeo calbasu*) and Morakha (*Cirrhina mrigala*). Chilwa was in enormous numbers in all the bays. The big fish were seen in the bays at the downstream side. The ladder has been recently remodelled to make falls at its outlets by raising the floor.

The fish ladder on the left side, built on 'inclined plane system' has still got one long slope from the upstream to the downstream with intervening incomplete baffle walls. The force of the current when water is run into it is too strong for fish to ascend at the time when there is no water in the river at the downstream, viz. close to the entrance of the ladder. During July, August and September when the river downstream has water, the head of the water at the upstream end of the fish ladder is not so high, and the difference between the level of the water in the river upstream and downstream is much reduced, the fish are then able to ascend the left fish ladder as well. There are grooves in the baffle walls of three bays; the kurries were put in these on the 16th April 1937 and a fall of 4 feet was thus created. Rohu (*Labeo rohita*), Kalahan (*Labeo calbasu*) Morakha (*Cirrhina mrigala*) and Theila (*Catla catla*) varying in weight from three to five seers were seen leaping near the fall. The fall being too high to be surmounted, the fish fell back in the lower bay.

The fact that one fish ladder is working satisfactorily should not be considered sufficient for such a long weir as that at Suleimanki. It would be giving a fair chance to fish near the left bank if the left fish ladder were remodelled and made to work satisfactorily throughout the season.

On the day of my visit to Headworks at Suleimanki a number of large sized carp such as Rohu (*Labeo rohita*) and Morakha (*Cirrhina mrigala*) and others were observed leaping against the iron shutters of the undersluices of the weir at places where water was leaking through the interspaces between the shutters and the wall of the weir. On attempting again and again, though invariably in vain, to ascend the narrow vents of the undersluices, the fish became bruised and fell down exhausted on the floor of the apron of the weir and were caught by the canal menials. On such occasions it is almost a common practice to simply hang down baskets and catch the leaping fish.

Islam Headworks. The Bahawalpur, the Mailsi and the Qaimpur Canals take their water from the river Sutlej at Islam. The weir was constructed in 1926, and reconstructed in 1930. The fish ladder was constructed in March 1930, at a cost of Rs. 3,86,752. Though constructed at such a high cost, the fish ladder has never served its purpose. It is more of a fish trap than a fish ladder. It has been constructed inside the Right Divide wall. Starting from the downstream the fish ladder consists of ten bays of trapezoidal shape, each measuring ten feet by eight feet. Further on the ladder consists of forty small compartments. Out of these, sixteen measure 4 ft. 8 ins. by 8 ft. each, and twenty-four measure 5 ft. 4 in. by 8 ft. each. The slope in the upstream compartments is one in twenty-four and in the downstream ones it is one in twenty-seven. The dimensions of the openings in the baffle walls are 1 ft. by 1½ ft. and of the inlet and outlet of the ladder 3 ft. 4 ins. by 4 ft. 4 ins. Kurries are provided in the inlet and outlet for control of water. The ladder ends blindly in front of the upstream end. There are however two windows, each measuring 4⅓ ft. by 3⅓ ft. on each side of the ladder. The fish might enter the ladder from the downstream entrance, but it seems doubtful whether they can jump into the upstream pool through the windows when water is rushing through them with great velocity.

The total length of the ladder is 355 feet and the difference between its upstream and downstream levels is 16·75 feet. But as neither any steps nor a pool at the entrance of the ladder for the fish to collect before making the ascent are provided, the ladder as such has never worked properly.

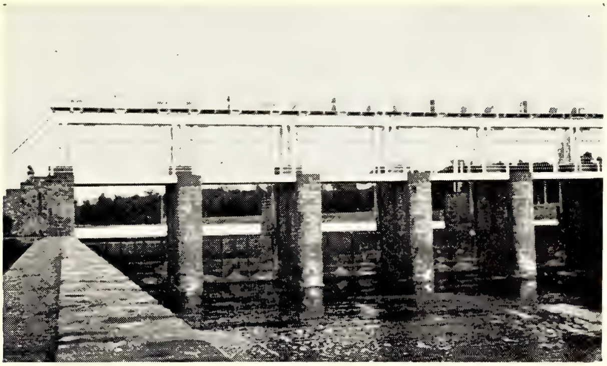
Panjnad Headworks. The Panjnad and the Abbasia canals take their water from the River Sutlej at Panjnad. The weir as well as the ladder were constructed in 1931. The latter being incorporated in part of the length of divide groyne, it is not possible to give its cost separately.

The ladder consists of twenty bays, each measuring 7 feet by 8 feet with incomplete baffle walls, leaving an opening 2 feet wide. It is constructed on the Cail System with a fall of one foot at each bay. The difference between the upstream and the downstream level of the ladder is 20·5 feet. The working of the ladder has not been observed by the writer, but from the reports received it is said to be used both by the small as well as the large fish during the season.

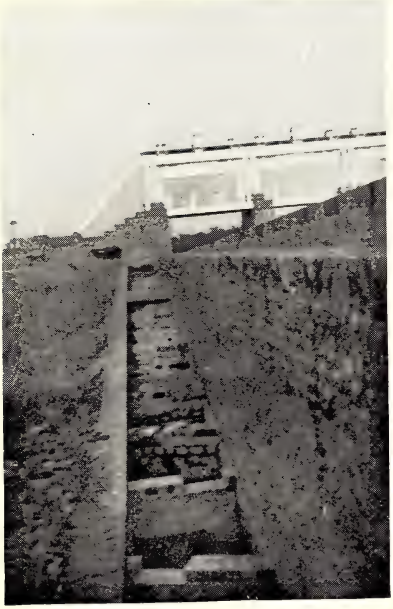
RIVER RAVI.

Madhopur Headworks. (Plate II). The Upper Bari Doab Canal takes its exit from the River Ravi at Madhopur. The weir was constructed in 1870, and for 58 years no passage for the fish existed in the weir. The total length of the weir is half a mile. It was in 1928 that a fish ladder was constructed at a cost of Rs. 4,018. The ladder (Plate II) consists of seventeen bays, measuring 8·5 feet by 5 feet with complete baffle walls, each having an opening two feet wide at its base for the passage of the fish. The fish ladder has, therefore, been constructed on the Cail system. The difference between the upstream and the downstream level of the ladder is 13 feet. The falls are created by means of wooden planks fixed in the grooves in the baffle walls. The slope is one in fifteen. The inlet of the seventeenth bay at the upstream end opens into a compartment measuring 34 ft. by 5 ft. which leads into another compartment measuring 25 ft. by 5 ft. The last compartment opens into the river just close to the inlet of the rafting bay. The flow of water from the river is controlled by gates.

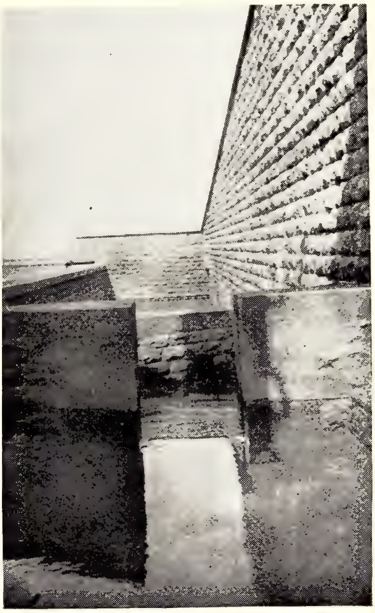
The entrance of the ladder at the downstream end is not very conspicuous. The area in front of the fish entrance is liable to shingle upto a level higher than the minimum water surface level and such shingling closes the entrance and puts the ladder out of action when the river is low. The entrance is located in a divide wall and is not self advertising. Small fish run up the ladder, but the large ones seem to prefer the rafting bay which



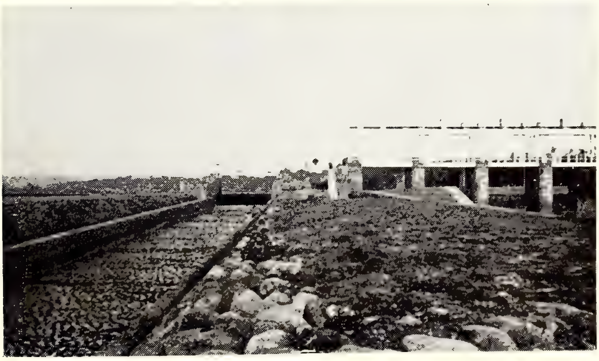
Weir across River Ravi at Madhopur Headworks.



Fish ladder at Madhopur.



Fish ladder at Khanki.



Rafting bay at Madhopur.

is 20 feet wide, and lies adjacent to the fish ladder. Whenever the water is flowing in the rafting bay the fish have invariably been seen running up the channel. The fish ladder at Madhopur is, therefore, not working satisfactorily and a design for a new ladder is under consideration with the Irrigation Department. The main data in this design are as follows:—

1. The number of compartments of the fish ladder is seventeen, each compartment measuring approximately 15 ft. by 10 ft., and the total length of the ladder equals 221 feet.

2. The bed of the river at inlet is R.L. 1135·5 and the ladder at tail is R.L. 1124·1, thus the difference is 11·4 feet; the fall is 10·4 in 221 feet. Kurries are used for the control of the water.

3. The opening in the baffle wall is 2·75 feet wide; the inlet is 3 feet wide and 2·5 feet high in winter. The outlet is kept 4 feet wide.

Balloki Headworks. The Lower Bari Doab Canal takes its exit from the River Ravi at Balloki. The weir was constructed in 1913 and the fish ladder in 1921. The total length of the weir is 1646·5 feet and that of the ladder 127·05 feet. The latter consists of seventeen bays, separated by baffle walls. The width of the openings in the baffle wall is 2·0 feet, the inlet measures 1 foot 4 inches by 2 feet 2 inches, and the width of the outlet is 2·01 feet. The bay is of trapezoidal shape and measures 6·3 feet (mean length) by 5 feet. The upstream bed level is R.L. 621·0, and the downstream bed level R.L. 616·5, the difference being 4·5 feet. A drop of 0·8 feet in the water surface level has been allowed in each bay. There is a regulating iron gate on the upstream side to control the water, and kurries are put in the grooves provided in the divide walls so that the working of the ladder can be made more flexible for the difference in the upstream and downstream water levels. Pipes are also fixed at flood levels in order to drain off water for inspection purposes when the downstream water level is R.L. 616·5. The ladder is of a very old type, more or less of the Inclined Plane Pattern, and has never worked properly.

Sidhnai Headworks. Three Canals namely Sidhnai, Fazilshah and Koranga take their waters from the River Ravi at Sidhnai. The weir was completed in 1886. There has never been any fish ladder provided in the weir for the passage of fish.

RIVER CHENAB.

Marala Headworks. The Upper Chenab Canal takes its water from the River Chenab at Marala. The weir at Marala was constructed in 1910 and the fish ladder, though not definitely known, is also reported to have been completed in the same year. It is an old type of ladder, more or less on the lines of the Inclined Plane System, with straight baffle walls, and is wedged in between the two high walls of the weir. There are six compartments measuring 12 ft. by 10 ft. each. The difference between the upstream bed and the downstream bed of the ladder is 6·17 feet. The slope is one in fifteen. The width of the openings of the baffle is 2 feet. The flow of water in the ladder is regulated by wooden kurries. Its last two compartments had been dismantled during the course of certain experiments by the Irrigation Department. No fish was seen in the ladder on the 19th April 1937. The ladder, does not seem to have fulfilled its purposes. It requires extension for at least 30 feet or so, so as to join it to the deeper parts of the downstream of the river. The side walls as well as the baffle walls should be raised to prevent overflooding of the ladder as otherwise the movements of the fish will be hindered.

Khanki Headworks. The Lower Chenab Canal takes its exit at Khanki from the River Chenab. The weir was constructed during 1889-92 and its length is 4403·5 feet. The fish ladder (Plate II) was originally constructed in 1912-13 at a cost of Rs. 1,427, but was dismantled in 1934-35 and substituted by a new one 203 feet in length at the same place, and being a portion of the constructing undersluices in Bay No. 8 its cost separately is not available. The new fish ladder consists of 16 bays, with incomplete baffle walls. The dimensions of the openings in the baffle wall is 2·5 feet (Fig. 6). The slope is one in ten. Arrangement for the control of water is by kurries in compartments and by gate at the entrance of the fish ladder.

It has been designed on the system of improved Cail Fishway but is not self advertising. The entrance to the ladder is 3 feet wide and is on one side. No fish has ever been reported to use it so far. Further improvements to the ladder are under consideration and it is intended to make falls of 15 inches at the entrance of each compartment or 'bay'.

RIVER JHELUM.

Mangla Regulator. The Upper Jhelum Canal takes its water from the River Jhelum at Mangla. There is no weir across the river at this Head and a natural shingle bar in the river bed serves the purpose. There is, therefore, no fish ladder at the head.

Rasul Headworks. The Lower Jhelum Canal takes its exit from the River Jhelum at Rasul. The weir was constructed in 1901 and the fish ladder was completed in the same year at an approximate cost of Rs. 15,200. It consists of 7 bays, six measuring 13 ft. by 10 ft. each, and 21 ft. by 10 ft. at the entry, with incomplete baffle walls leaving an opening of 3 feet width for the passage of the fish. The dimensions of the inlet are 10 ft. by 7·5 ft. and of the outlet 3 ft. by 3 ft. There is an under shot gate at the entry with which the regulation is done. There are kurries in the baffle walls to control the water in the bays. The ladder has been constructed on the Cail system and is almost identical with the one at Marala. It is too steep and there is a heavy flow of water. It has not worked very satisfactorily and has only occasionally been used by small fish, such as Chilwa (*Aspidoparia morar*), during the season. Bachwa are very rarely seen ascending the ladder to reach their spawning grounds in the upper reaches of the river.

CONCLUSION.

Most of the fish ladders in the Punjab are ineffective and their main defects are:— (i) the majority of them are too steep and too narrow; (ii) the upstream inlets are generally too severe to allow the smaller species of the migratory fish to ascend; (iii) the downstream openings in most cases are too small, and therefore too inconspicuous to be perceived by the ascending fish, that is to say, the fish ladders are not self advertising; (iv) there is hardly any pool at the entrance of the ladders where fish could collect before ascending; (v) the water supply in the ladders is not available during the periods when the fish migrate; and finally (vi) the majority of them are not fish ladders but mere fish traps for catching fish.

The effect of inefficient fish ladders in the Punjab is beginning to be felt in the higher reaches of the rivers and there seems to be no doubt that as a result of it the stock of fish in the Punjab rivers has decreased very considerably during the last fifteen or twenty years. The Honorary Secretary, Dehra Dun Fishing Association, has drawn the attention of Government of India to the following fact: 'We believe the Mahseer, the most important of the Indian fresh water fishes is being gradually wiped out and we submit the question of conservation of the species is a matter of such importance as to deserve the most careful consideration.'

Water is no doubt of far greater importance to the prosperity of the Punjab than fish, but if the cost is not unreasonable, the question of improving the fish ladders and keeping them working requires consideration and attention.

The indiscriminate slaughter of fish in the canals which run for thousands of miles in the Province has continued for more than sixty years. The destruction of fish life in the canals during the closure period was brought to notice as long ago as 1873 by Day, and in 1888 by Thomas, and again in 1911 by Dunsford; but unfortunately, so far, no action seems to have been taken in the matter of adopting suitable measures to save the fish from such a wholesale destruction. In short, ineffective fish ladders in the weirs, total absence of any passes in the canals, existence of unsurmountable falls at the heads of most of the canals, and the indiscriminate slaughter of fish during the closure period, seem to be the main factors responsible for the deterioration of our inland fisheries.

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WILD ELEPHANTS IN ASSAM.

BY

J. E. HALL.

(*With a plate*).

There must be dozens of shikaris, like myself, who have been, or are mad keen to 'bag' a Rogue Elephant. Well Assam is the place for them to go to. For years, one of my boyhood ambitions had been to track and shoot elephants. 'Thirteen years amongst the Wild Beasts of India' by that famous 'Hathi-King' G. P. Sanderson, served to keep the flame of desire burning bright. That ambition was eventually realised after twenty years.

A few years back the shooting of elephants, except for an occasional 'Proscribed Rogue', was totally prohibited. Such Rogues when very occasionally proclaimed, were soon destroyed by local sportsmen; long before any '*bandobast*' could be made by an outsider. The steadily increasing popularity of the motor-car has however ousted the elephant from favour; and the present demand for these useful beasts from Rajas and wealthy Indians is very small in comparison to former years. With little or no organised Keddah catching operations and strict protection, wild elephants have so increased in numbers that in certain areas they are a menace to cultivators; and as a result have to be controlled.

Early in 1938, several 'Rogues' were proscribed in various parts of Assam and I made up my mind rather suddenly to have a try at shooting some of these. Imagine me, therefore, having landed in Gauhati, without any *'pucca bandobast',* not even knowing where to go to find elephants. Luckily there was an old school-fellow stationed there: and he very kindly gave me a letter of introduction to the local Forest Officer.

In the course of my Shikar wanderings throughout India, I have met dozens of Government officials; but for 100 per cent. sheer sportsmen give me those of the I. F. S. The local D. F. O. not knowing me from Adam, was the sheet anchor of my hopes; and believe me I was not disappointed. Within a few hours he had fixed me up with an Elephant Control License which empowered me to shoot any solitary male elephant. Tuskers to be balanced by Makhnas. He also advised me in what areas in his Division elephants were reported to be doing damage and, as a final effort, gave me a letter to his subordinate officers, asking them to help me in my trip. As an A. 1 sportsman, in the true sense of the word, I take my hat off to that D. F. O. May his shadow never grow less. Having arrived at a place called Ranigodam, near where a Rogue had been reported, I installed myself in the local Dak-Bungalow. This is where I came up—hard— against the Assamese villager. Not a man, cart, or service of any description were to be hired or bought. Payment was no consideration, they just would not face the work. Quite possibly some of the 'Mahaldars' or lessees of elephant catching, who were operating in that area, engineered this boycott.

They probably reasoned that if I started shooting bull elephants their operations would be spoilt by the wild elephants retiring back into tribal territory. Nor could I hire tame elephants, they were all engaged in *Mela-Shikar.* I was now in despair; the immediate prospects of success were very remote. At this very unpleasant moment, the D. F. O's ranger came to the rescue. A very quiet and reserved young man, his suggestion was that I shift my camp to a village called Chakardah, about 6 miles away; and that at this village I could get into touch with a retired pensioner of the Assam Rifles, a Gurkha, called Balbahadur, who had the reputation of being a famous shikari.

We decided on action, it took 8 hours to raise a bullock cart from the villagers; yet when it was produced the hire demanded was reasonable enough. This I personally paid into the village head-man's hands, and he seemed surprised to get it. It afterwards transpired that the Mahaldars had let out a rumour to the effect that I was requisitioning men and carts without payment, being a military officer. What a libel on the unfortunate military! Later on the Mahaldars became friendly, when they realised that I was not interfering with their business.

Having set out in pouring rain, I arrived like a drowned rat, to find Chakardah most depressing. A fairly large village nestling at the foot of dense jungle clad hills, with a large swampy lake as a foreground, and a few paddy fields scattered about. We managed to get shelter in the Forest Guard's *chowki,* a single-roomed hut, that bore evidences of a recent attempt by a wild elephant to pull it down. It was quite isolated, having as its solitary neighbour Balbahadur's shack. The swampy lake was filled with resident species of wild duck, paddy birds, cranes, etc.; whilst all day long herds of semi-domesticated buffaloes grazed in the swamp grass tended by Gurkhali herdsmen. Balbahadur soon entered into an agreement with me and in no time produced an Assamese tracker named Kuttru, and another non-descript assistant. Kuttru, I may say, was an excellent tracker, who never lost a trail, and that, in spite of the fact that the tracks we were following were crossed and confused continually by those of herd elephants. Up and down the bamboo covered hills, through Taraban swamps, Ringal cane thickets, lantana, it was the same to him. He would lead you right up to an elephant and say *'Maro'.* I once asked him if he ever felt afraid, and his reply was most amusing and to the point. I give it verbatim. 'You have come to shoot elephants not I, so long as you don't run, I won't, if you do, I'll go home. The last Babu-Saheb who came after elephants ran away after wounding an elephant, and we were nearly all killed. If it comes to running, rest assured I can run and climb trees much faster than you, and in any case my business is finished when I take you up to the elephant'. When not tracking, his chief amusement was to wade into the swamp, in pouring rain and spear fish. He caught an enormous number of a sort of mudfish, which he carefully dried for future consumption. I once tried a couple fried and they were very tasty, so that he had to provide a couple for my breakfast whenever we were not out tracking.

Balbahadur on the other hand was a most taciturn individual, seldom spoke unless directly addressed, was slightly deaf and absolutely fearless. He never backed a step when facing elephants and I veritably believe would rather have been killed than lose *Izat* by showing fear. His chief relaxation I may say was drinking large pegs of my whiskey, neat. Every performance being followed by frightful grimaces and the explanation that Whiskey kept fever out of his stomach. He had a head, and could down half a bottle without showing any effects. On one trail we lived on whiskey and tea for nearly two days, most of the time in pouring rain; and were never really dry. His prescription must be right as I never got fever, to which I am rather prone in the jungles.

A couple of blank days were spent in trying to pick up the Rogue, which however had disappeared after demolishing a couple of cooly huts at a nearby tea-garden, following up this exploit by chasing two Nepali sawyers who were cutting timber in the forest.

He then wound up by eating all their provisions, including some rice tied in a red cloth, cloth and all. Confirmation of this feat was forthcoming when his droppings were found. These were plentifully garnished with scraps of red rag.

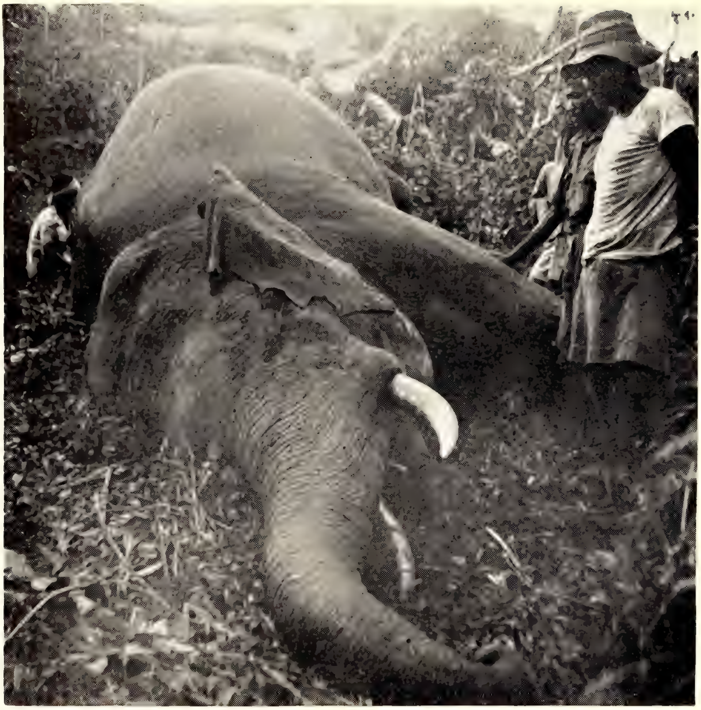
During the course of my wanderings on this shoot, I came across a 'Mithun', a type of hybrid Gaur found in Assam. He gave an easy shot as he fed in some short grass on the opposite side of a ravine about 80 to 100 yards away. I could have bagged him easily, but having no license for Game in this area, very reluctantly had to let him go, as to-date I have never bagged a 'Mithun'. I also saw a Red Serow, a rare animal, but this peculiar brute raced downhill into a dense Ringal cane thicket. Several times we came across pig, sambhur, kallij pheasant, *jungli moorgi,* and once one misty morning walked into a tiger on his kill—a village cow. I should have shot him, as actually he was on village land, but not knowing this at the time I was not chancing the forfeiture of my elephant license by being accused of poaching. Both Balbahadur and Kuttru urged me to shoot this tiger, though we were all on foot within a few yards; and they had the pleasure of saying 'I told you so'; when we heard from the Ranger, that this beast was a nuisance having killed several buffaloes engaged in timber dragging and that I should have shot him as permission had been obtained for his destruction.

Eventually during the course of our wanderings, we came across a village of Garo tribesmen, high up in the hills. These were not the real wild type, rather semi-civilised fellows, and they gave us *khubbar* of two solitary elephants in the jungles. They were quite willing to work for me and wanted us to visit their village. This suited my purpose admirably, as it solved the problem of transport; I was also tired of Chakardah and its everlasting swamp. To settle the business I tramped straight on to their village just as I was, and we celebrated our arrival by getting our hosts to throw a feast of roast pig and rice beer. Of course I had to pay for these festivities, which waxed loud and long; and had the satisfaction of dining alone on tea and tinned sausages in isolated splendour in the Forest Guard's beat hut. Such are the disadvantages of keeping up one's prestige. My shikaris enjoyed themselves, but had the sense to send out a party of men early next morning to bring in my kit, servant, etc. This party returned with everything by 11 a.m. Good marching as the total distance involved was 14 miles up hill and down dale through heavy forest.

The next afternoon we picked up the tracks of an enormous solitary elephant, the print of whose forefeet gave a circumference measurement of 65″, or a computed height of 10′-10″. The tracks were about a day old and we followed them till nightfall, through the most impossible places, up and downhill almost vertically, in regular giant staircases of elephant tracks; through Tara-ban swamps, up to our waists in stinking mud and water, through dense rattan-cane thickets that dug millions of vicious barbs into one and tore clothes and skin to shreds. Periodically we stopped to scrape off leeches, as fat as my little finger, with the gorge that they had had of our blood. I invariably burnt these dreadful pests. This devil-ridden elephant never seemed to stop, his tracks showed that he was moving fast. That night we all went to sleep on the banks of a brawling tumbling stream that looked beautifully fishable. No fires were allowed and we huddled together cold and hungry. Towards midnight we heard the trumpeting of a herd of wild elephants, away to the south-west; later a single elephant rushed madly up the valley we were sleeping in, most probably after catching our wind. What with mosquitoes, cold, hunger and excitement, I hardly slept a wink. Towards morning I dozed fitfully, and woke to find that Balbahadur had made some tea; and that Kuttru and Bangté, the Garo Headman, had gone on ahead tracking.

A hasty wash, followed by some whiskey-tea and we pushed on; some hours later we contacted with Kuttru, and he was a case of 'nerves'. It appeared that he and Bangté, whilst following the elephant, had been most viciously charged. I had my doubts, but these were allayed when we came to the scene of action. We could see where the elephant had circled back to a bamboo clump, from where he had charged the two men from not more than 15 yards. The tracks of his charge were deeply imprinted on the soft soil as his direction was downhill.

He had then crossed a swamp and ascended the opposite hill which was covered with dense bamboo thickets. Kuttru with a most ridiculous looking *dah* in his hand took up the tracks, but as these were now so clear I took the lead. The wind was wrong and the advance was made with great caution. I may state that I smoked continually, this being the easiest way of testing the breeze in these dense damp forests, where sand, a wet finger, or fluff are alike useless. The elephant, as we found later, had crossed the ridge and circled back along the top of a spur running



Kamrup, Assam. Rogue Elephant—9′ 7″: Tusks, R. 3′ 11″, L. 3′ 9″; Circum. 1′ 1″; Weight 34 lb.

Kamrup, Assam. Rogue *Makhna,* 10′ 2″.

west. We must actually have passed him within 60 yards, but much below his line of scent or smell. On topping the ridge, I was following up the tracks, when Kuttru, who has the eyes of a hawk, spotted the elephant 40 yards away behind a dense bamboo clump, on our right. The beast was perfectly motionless. To get a shot at this distance was impossible, there were far too many interlacing bamboos and besides the elephant's quarters and tail were towards us. He looked a monster, reddish brown in colour, quite unlike the usual black tame ones. I got *pucca* stag fever, my hands shaking with excitement: Kuttru looked at me in a very superior and pitying way and I mentally promised to box his ears when the show was over. Balbahadur quite frankly suggested that I sit down and recover my nerves, whilst he had a crack at the elephant. Recovering myself I got them behind a bamboo clump, whilst the Garos made themselves scarce. I then crept up behind the bamboo clump, till only this separated the elephant from me. He seemed very suspicious and kept swinging his head and trunk from side to side apparently to catch the wind. I then saw for the first time that he was a *makhna,* or tuskless male. I had no qualms about shooting him, owing to the conditions of my license. How long I waited I don't know, probably not more than a minute. I then discovered that Kuttru had crept up to me without a sound; he suggested in a whisper that I step to the right of the clump and as the elephant swung round to face me, to let him have it. I did so and stood up, without a sound the elephant swung towards me and I let drive midway between his ear and temple. With a great scream he came round but fell onto his knees, and whilst he was struggling to rise, I rushed up and fired just above the bump between his eyes. He heeled clean over and I had bagged my first elephant. Besides the natural exultation I felt, I must admit to pangs of regret at having destroyed so magnificent a beast. Measured between uprights, as he lay, from the top of his shoulder to the sole of his forefoot, he taped 10′ 2″; the circumference of his right forefoot in death was 62″. In my opinion he stood about 10′-5″ in height (vertical) at the shoulders; and this measurement was confirmed by his rubbing marks on various trees. His tushes were both broken off short at the gum, but for a *makhna* were still exceptionally long and thick. When his carcase was seen by the Mahouts engaged in *Mela-Shikar,* they said that he was the biggest elephant seen in these parts for years; and was known as a notorious crop raider, who occasionally chased people about, but he was not a man-killer; and had been living solitary for many years. They estimated his age as between 80 and 100! The ears were very ragged and showed a great amount of turnover. The bulk of the body was enormous. In a couple of days no one could go within a mile of the place due to the terrible stench.

The next few days were devoted to observing wild elephants and their ways, whilst scouts were sent out to hunt up the recent tracks of the other solitary elephant,—the Rogue. One morning as we were on our way to a salt lick, situated in a narrow valley where we hoped to see elephant and with luck Mithun, we heard a herd approaching in the opposite direction. We rushed a little way uphill and sat tight and were soon rewarded by seeing 8 cows and 3 calves walking along in Indian file, not more than 50 yards distant. The moment the leading cow crossed our tracks, she stooped dead and tested the wind, in no time her trunk swung in our direction and every other elephant followed suit including the tiny calves. Right about wheel, canter, seemed to be next orders and they shuffled away uphill as fast as they could go with a tremendous crashing. The whole movement was executed as if on a parade ground and we all had a good laugh at the gravity of the little fellows. Another afternoon, Kuttru, the valiant, led me right up to two young tuskers, that had temporarily left a herd. The larger of the two was about 8′ 6″ in height with light tusks, Khuttru called him a *Khuru-Dantal* the other was not above 6′-0″, with tiny tusks just protruding from his jaw. The blood-thirsty tracker wanted me to shoot both. I got to within 5 yards of them and climbed a tree to get some snapshots. It was delightful to see how they caressed each other with their trunks and how the smaller copied every movement of his elder brother, even to rubbing his forehead on the same tree.

Eventually Balbahadur, who originally had lagged behind, came blundering on the scene, upon which the elephants rushed off downhill. They just bounded down like dirty black rubber balls, the smaller of the two coming an awful cropper over a log in the grass. He looked such a clown with his head on the ground and his hind legs stubbing the grass, that I sat and roared, sending off the herd that was in the valley crashing away at a great pace.

One day when following up a solitary *ganesh* or single-tusked elephant we ran slap bang into a herd, which he had suddenly joined up with. The place was a sort of natural ampitheatre, a flat, tree covered hollow, surrounded by high bamboo covered hills, with steep sides. The herd was right around us, split up into what appeared to be family groups, all resting under the shade of the trees. The two nearest groups were all cows and calves, then a solitary *makhna,* not however anything as large as the one I had shot. Not far from him and close to a group, headed by an immense old cow, stood the '*ganesh*'. Unlucky brute for me, had I caught him up when solitary, I was justified in shooting him, as he was a known crop-raider; but within the shelter of a herd he was in sanctuary and inviolate. His one tusk was every bit of 65 lbs. if not more, as thick as my thigh and projecting 4 feet from his jaw, stained the colour of nicotine, with the point rounded and blunt. Out of his head, it would have gone to 6′-0″ in length. Balbahadur, as usual, got us all into trouble. Close to where he crouched, about 15 yards to my left, was a pinky-grey calf; the little chap could not have been more than a few weeks old, he was trying to pull down a creeper with his tiny trunk. Balbahadur spotted this progidy and crept to within a yard of it. He had a shawl in his hands and seemed to be trying to tie its hind legs together, in an effort to capture it. At this moment the old cow spotted him and with an unearthly scream charged headlong at him. Pandemonium is the wrong word to describe the next few moments. The entire herd consisting of some 40 animals, rushed over everything screaming, bamboo clumps were scattered, the individual stems cracking like rifle shots. The whole place was like an inferno, only, instead of comparatively benign devils, there were dozens of infuriated and frightened elephants. I hardly know what happened to the rest, I saw Kuttru and the Garo shin up the hillside and Balbahadur dodge behind a bamboo clump. I ran across to him and was nearly run over by a couple of runaway cows. The *mukhna* was screaming just the other side of our clump, so we faded silently away up the opposite hillside to Kuttru and the rest. The *ganesh* had disappeared, and by the time we had rejoined forces, the herd who were still in possession of the arena, started filing away. We counted 33 animals, but others had already made good their escape. Later on we heard from the Mahouts that they had captured 2 young elephants from that herd a few days previously, one of them being a young tusker whose dam was the old and vicious cow. She and the *makhna* had then turned on the *koonkees,* or catching elephants, and severely pummeled a valuable female, whilst the rest showed such a pugnacious disposition, that they had decided to leave this herd alone. One of the Mahaldars offered me Rs. 500 to catch the calf we had seen, as it was supposed to be an albino and very valuable. He also offered to lend two *koonkees* and his Mahouts, *phandees* or noosers, and pay all expenses. His Mahouts were however a miserable opium eating lot; and he a great sharper, so that nothing came of his proposal. On the other hand, some Gurkha Mahouts and *phandees* in the service of another Mahaldar, were a desperate gang. I did one hunt with this lot, as a paying guest; and they did show sport. Having closed up to a herd, away they rushed in, cutting out two half-grown young with their *koonkees.* There were two of us in this particular case, and we followed that calf through swamp and bamboo, along the valley. My companion *koonkee* did the actual noosing, as she was a leggy and fast female. My mount being a much slower *makhna* who however came up in time to help in the final roping and tie-up. I finished that little jaunt more dead than alive with not a square inch of skin on the inside of my legs. You must know that these *koonkees* are not fitted with pads, only ropes, and one has to hang on with hands, teeth and toes; but falls to rival those experienced in pig-sticking are frequent. I paid the promised 'bakshish' to my Mahout and was thankful to get off his elephant alive, and with no bones broken; any more sport of this description would have meant a lengthy stay in hospital for me. I may add that my part in the hunt was to beat my mount with a thick stick over the rumps, to make him move faster, as I had displaced the *charkatta;* only two being carried per Koonkee in this Mela-Shikar. You may guess that

I did nothing of the sort being too busy hanging on for dear life. Whilst our pair of *koonkees* were successful, another lot had a fearful time, one of the *phandees* being swept off his mount by a trailing creeper, his *koonkee* was useless for further catching; the other had to cut loose the calf they had noosed, as he was too big for their mount—a very light female, and besides dragging her along, very nearly choked himself in the noose as a result. Altogether a very successful hunt; and the Mahouts considered me very lucky and wanted to take me out again, but one experience sufficed. However all good things end, and I returned to Chakardah on my way home. On my very last night in the jungles, the Rogue, who had protected his hide so well that we never once caught a glimpse of him in spite of continual hunting, staged a grand *Finale;* which ended in his enriching me with his beautiful symmetrical tusks. I had finished packing my kit and rifles, and after a hot bath, the first for many days, had turned in amidst the unwonted luxury of warm blankets, clean sheets, and silk pyjamas. I was asleep almost before my head touched the pillow, and was in the middle of a vivid dream, wherein a monster elephant with long curly tusks, absolutely impervious to all bullets was chasing me; when a fearful scream from an elephant made me wide awake. Balbahadur rushed to my hut from his own, and shouted elephant; meanwhile the screaming and noise went on, added to which were loud shouts and wails from the village where the Mahaldars had picketed their *koonkees.* I developed some latent energy that I consider is unexampled. Within half a minute I was rushing to the scene of tumult in my pyjamas and slippers, with the heavy rifle in my hands and the last 7 cartridges I possessed. To get there I had to wade through an arm of the swamp and cross some 400 yards of flooded paddy fields. In the process, I lost my slippers, lost my bearings and landed up to the armpits in a bog. Some of the Mahouts with a lantern, rapidly came on the scene and extricated me. Whilst rushing me along to their lines they gasped out their story. This summed up was to the effect that during the day a solitary bull *dantal* or tusker had been seen following one of their *koonkees*—a *makhna.* This latter had been showing signs of 'musth' and as a result had been securely chained up that evening. Towards nightfall he started showing signs of great restlessness. About midnight, an elephant trumpeted in the jungle nearby, to which the *makhna* answered and about a quarter of an hour later, when they were all asleep, the wild tusker crossing through the outlying part of the village, came into their lines. The first intimation they had of his presence was when he attacked the tame *makhna.* The screams of the latter awoke them in a fright, when they noticed that he was bleeding from a wound near the shoulder, inflicted by the Rogue. In spite of their shouts and the waving of lighted fire-brands, the Rogue, who had backed away at their first approach, again charged the unfortunate *makhna,* driving one of his tusks into the base of the latter's trunk. Eventually the tusker knocked down the *makhna,* not a difficult task as the latter's fore-legs were shackled by chains. By this time the entire village was in the utmost confusion, men, women, and children, ran about screaming that their last day had come. The *makhna* continued his terrible screams as the wild tusker pummelled and kicked him. The moment I arrived was very nearly my last; in pitch blackness, under a steady drizzle of rain, a horde of frantic men, women and children laid hold of me. At this moment a Mahout came running up with a firebrand and the tusker who previously had not been visible under the shade of the trees, stepped forward into the circle of light about 50 yards away. In the mad stampede that immediately ensued, I was swept into a ditch by the solid wave of humanity that rushed back; with fists, legs and gun-stock I had to fight my way clear otherwise I would have been suffocated. As this ditch was practically an offal pit for a nearby cattle pen, my odoriferous condition can be better imagined than described. Eventually, with myself standing guard over the tusker, Balbahadur, my orderly and the Mahouts, drove the panic-stricken villagers into the comparative safety of the cattle-pen, thereby clearing the field for action.

Supported by Balbahadur flashing the electric torch onto the tusker's head and carrying my second rifle, we started the attack. The tusker fronted us and came on; when he was about 10 yards away I let drive into the spot where I judged the bump of his fore-head was placed. He swayed to the shot and recoiled backwards, then recovering himself rushed us without a sound; Balbahadur dragged me back into a Lantana bush. As the elephant passed I fired for his ear, but hit him in the centre of his neck, as by this time I was firing in the dark; the blasted torch having dropped in the confusion. He screamed loudly to the shot, and appeared to be half paralysed, as he started moving in a blind sort of a way, very slowly, uphill. I ran alongside in the thick Lantana, and fired three times at his head, trying to brain him, but in the dark could not get the correct spot. Fumbling in my pocket I discovered that I had only one cartridge left, one having dropped out in the confusion at the ditch. The elephant was now standing in a dense clump of Lantana, so I ran right up to him and fired into his ear from about three yards. He dropped like a stone without a sound, just missing crushing me; as he had been on higher ground than myself. I literally escaped by inches. As it was I fled after taking the shot, as by this time my nerves were in shreds. The first to come up to me with a smoke was Balbahadur, who had been close behind; and I stopped to recover as much of my courage as I could. The rest of the crowd soon followed, and we jauntily announced the death of the Rogue. A 'stripped to the skin bath' followed at the elephant lines, and I put on some clean clothes, but was much too excited to sleep immediately. We sat up with the Mahouts gossiping and yarning, drinking copiously of tea laced with whiskey. They were fullsome with their praises, stating that they had never met any *Saheb* before, brave enough to shoot a *goonda-dantal* by night. I did not edify them, by saying that in actual truth, funk had dried up my throat to such an extent that I was left with a raging and apparently insatiable thirst.

Next morning after cutting out the tusks, I decided that as the carcase was within a hundred yards of the nearest huts, it was absolutely necessary to bury it, to prevent an epidemic when it rotted. The villagers absolutely refused to do this, in spite of my offering whatever wages they demanded. They said that it was too much labour and in any case the carcase would soon rot. Luckily the Forest Ranger came that morning, and he soon impressed some Garos and Cacharees who did the job. It was terribly tedious; whilst the coolies dug an immense pit, I had to cut up the carcase with Balbahadur. We were at it till 4 p.m. The above incident is typical of the attitude of Assamese Mikiri villagers. They just will not do any manual labour unconnected with their daily lives, whether paid for or not. To the men who had sweated all day, I paid the agreed amount of Rs. 25/- plus as much country-grog as they wanted, and they were very contented. They fully deserved every pice of that money. Late that evening the Ranger boated me back across the swamp up to the main road, where I soon caught a bus back to Gauhati.

I will not weary the reader with instructions how and where to shoot wild elephants; suffice to say that by Assam Government ruling the rifle must be a H. V. one of not less than 400 bore. He will learn everything there is to know from Sanderson's book. In Assam he must be prepared to travel light and foot-slog for miles. Carriage is very difficult to obtain and the use of tame elephants, unless he has local friends impossible. Tea laced with whiskey, following 5 grains of some quinine compound, twice a day is the best fever-preventive. Shooting rules in Assam are very strict, and Fees and Royalties ditto. This is excellent as, at least in the Forest Reserves, it prevents indiscriminate slaughter, as was the case in years gone by. I have no actual experience, bar Elephant shooting, of the Forest Reserves; an omission that I intend to rectify no sooner funds permit. I should think that in some of these Reserves the shooting, though terribly difficult, will compare with anything the rest of India can produce.

Measurements. Măkhna Bull Elephant. Vertical height 10′-2″ but actually estimated at 10′-5″; Circumference of right forefoot, in death, 62″. Tushes 226 tolas the pair. Rogue Tusker: vertical height, 9′-7″, circumference of right forefoot, in death, 4′-8½″
Tusks, *Right.* 3′-11″×13″ girth at the gum; } Weight 34 lbs.
Left. 3′-9″×13″ girth at the gum; } the pair.

I forgot to add that in cutting out the right tusk we found a Martini-Henry slug embedded in the skull. This had traversed the tusk and entered into the bone of the skull, splitting the tusk for about 18″ of its length inside the socket. The pulp of the tusk was in a diseased condition, smelling horribly; and in my opinion was probably the sole reason why this animal turned into a Rogue. He must have been wounded by either a crop watcher or shikari, and subsequently must have been in agony for the rest of his life. The tusks are a beautifully matched pair, with sharp pointed ends.

NOTES ON INDIAN *EUPHORBIACEAE*: *CROTON BONPLANDIANUM* (C. *SPARSIFLORUM*) AND *EUPHORBIA PERBRACTEATA*.

BY

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Thanks to the friendly interest of several botanists who have furnished material and data I have been able to give attention to certain Indian *Euphorbiaceæ*, native or introduced, the taxonomic status of which was thought to be questionable or unsatisfactory. Two of these plants, both weeds of cultivation, are the subject of this contribution.

(A) CROTON BONPLANDIANUM[1]

This is the introduced *Euphorbiacea* known to Indian floristic work as *Croton sparsiflorus*. Its synonymy is fairly extended although by no means one of the largest in the records of this badly known genus. So far I know it, it stands as follows:

CROTON BONPLANDIANUM Baill. in Adans., iv, 339 (August 1864); *C. Bonplandianus* [sphalm.] Mueller-Arg. in DC. Prodr. XV, ii, 661 (1866) and in Mart., Fl. Bras. XI, ii, 116 (1873) [sub *C. Persicaria*].

C. pauperulum [*C. pauperulus* sphalm.] Muell.-Arg. in Flora, XLVII, 485 (October 1864), DC. Prodr., XV, ii: 671 (1866), Mart. Fl. Bras., XI, ii, 242 (1873).

C. sparsiflorum [*C. sparsiflorus* sphalm] Morong [sphalm. auct. Indic. 'Morung'] in Ann. N.Y. Acad. Sc., VII, 22 (1892); Brühl in Jour. Proc. As. Soc. Bengal, IV, 604, 635; 642, 649, 652 (1908); Haines, Bot. Bihar, Orissa,

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[1] *Croton* was used by Linnaeus [Sp. Pl. II, 1004 (1753)] as neuter generic name and by Mueller-Arg. [in DC. Prodr. XV, ii, 512 *et seq.* (1866)] as masculine, most modern authors following Mueller's preference. Article 72 (1) of the International Rules of Nomenclature, 1935, statutes that a Greek or Latin word adopted as a generic name retains the gender assigned to it by its author which is known to have for result that the same Greek or Latin name is masculine, feminine or neuter according to the letter of the original publication. A modification of Art. 72 (1) was proposed [cf. Syn. Propos. Nomencl., VI, Inter. Congr. 58 (1935)] to the effect that generic names must follow their classical gender. This proposal, at first voted upon favourably [cf. Proc., VI, Inter. Congr., 356 (1936)] was eventually accepted only as a *recommendation* (cf. o.c., 357), which leaves the matter practically unchanged under Art. 72 (1). I regret that under the Rules the specific names of the majority of the synonyms of *C. Bonplandianum* must here be changed to the neuter gender, because this further complicates the synonymy. *Croton Bonplandianum* was published as neuter by its author, Baillon.

II, 105 (1921); Gamble, Fl. Pres. Madras, II, 1316 (1925); Mayuranathan, Fl. Plts. Madras vicin., 267, pl. 31 fig. d (1929); Joshi in Curr. Sc. II, 344 (1934).

C. rivinoides Chodat in Bull. Hb. Boiss., sér. ii, I, 395 (1901).

The centre of distribution of this most vigorous weed is Paraguay, in South America. It occurs as far north as the temperate foothills of the Andes of Bolivia and is locally abundant in the warmer Andean and Pampean states of the Republic of Argentine. It is not reported from Uruguay by Herter [Estud. Bot. Reg. Urug. 79 (1930)], although it certainly occurs there. I have seen no specimens from the Rio Grande do Sul and other southern Brazilian states, where it can not be wanting. Various collectors record it as a weed of waste lands, banks of rivers and thoroughfares, several times gathered in the street of Asunción, Paraguay.

The history of *C. Bonplandianum*, briefly told, is the following: Aimé Bonpland collected it, apparently for the first time, at the beginning of the last century in the 'province of Corrientes', i.e. in an unreported locality near the common boundaries of Argentine, Paraguay and Brazil. It was almost simultaneously described by Baillon and by Mueller of Aargau, the latter having received through J. D. Hooker a specimen collected by Tweedie in the Andean region of Argentine, near Tucumán. For reasons unexplained, Mueller twice reduced *C. Bonplandianum* to *C. Persicaria,* which is a very different species. Thomas Morong brought it back from Paraguay, where he had been collecting between 1888 and 1890 and named it as new with the binomial under which it has since then been known to the majority of taxonomists. Chodat, eventually, introduced in the record a third synonym which has remained practically unused.

Compiling from the literature I find the following main records for *C. Bonplandianum* (*C. sparsiflorum*) in India: 1897, Chandur, Akhārēra, Brahmanbaria; 1898, Chittagong; 1901, Sibpur; 1907, Tippera; 1917-1921, various localities in Orissa; 1922, Madras and along the coast of Coromandel south to Tinnevelly; 1929, the greatest part of the districts of Madura and Tinnevelly 1931, Benares; 1932, Sylhet and Gauhatti. It is a foregone conclusion that *C. Bonplandianum* is scheduled to overrun in time most of India and, probably, a wide area of tropical Asia and Africa.

According to Brühl (o. c., 603) it was Prain who first identified this weed as *C. sparsiflorum,* Prain's specimens being probably still preserved under this binomial in the herbarium of the Botanic Garden at Sibpur. It should be interesting to verify the notes on this material, ascertaining how Prain, who did not record the species in 1903 together with the *Croton* from Bengal, came to learn of Morong's binomial. It stands distinctly to Prain's credit to have recognized the species with fair accuracy, considering how involved and unsatisfactory is the classification of *Croton* now current.

The illustration supplied by Mayuranathan is good and the account of Brühl is excellent despite the fact that in this account are found minor errors of citations and one omission, occurring in the quotation of Morong's original diagnosis. Having seen an Indian specimen of *C. sparsiflorum* in the herbarium of the Royal Botanic Gardens at Kew (Haines 4165, 'naturalized near Cuttack 1917') and types or isotypes of *C. Bonplandianum, C. pauperulum* and C. *rivinoides* in various European and American herbaria I am satisfied that the introduced weed recorded by Indian botanists and the South American *Croton* are precisely the same species. Individual specimens vary much in size, depauperate forms being scarcely 8-12 inches tall with narrow, acuminate, dentate-serrate leaves. Specimens which I have grown in the hothouse from seed received from Dr. F. Schade, of Villarica, Paraguay brought forth leaves up to 8 by 4 inches in size and showed great vigour, ultimately measuring fully 3 ft. in height.

In Brühl's account it is suggested that had Hooker known *C. Bonplandianum* (*C. sparsiflorum*) he would have listed it near *C. Wallichii.* So far as it applies to the habit and the general aspect of preserved specimens Brühl's note is acceptable, but the true affinities of *C. Bonplandianum* are not with *C. Wallichii* and its group. In the present state of classification it is unadvisable to make final statements on the subject of the affinities and sectional divisions of *Croton*, both Indian and foreign. At this time it seems correct, however, to refer *C. Bonplandianum* to sect. *Astraea* (Kl.) Baill., as typified by *C. lobatum,* this being another weed of cultivation that also probably occurs in India.

(B) EUPHORBIA PERBRACTEATA

This weed is of special interest to students of Indian phytogeography because it might prove to extend to the Deccan the range of forms such as *E. striatella* and *E. teheranica* that so far are believed to be restricted to the Iranian tableland. *Euphorbia pauciradiata* Blatt., which is known to me only from description, is possibly a third species of this group.

In describing *E. perbracteata* [*Bull. Bot. Gard. Kew*, xxvii, 238 (1914)] Gage warned that it was being confused with *E. dracunculoides* and *E. Rothiana.* Despite Gage's note the confusion persisted and Sedgwick took notice of it, writing an elaborate and in some respects very informative paper [*J.B.N.H.S.*, xxvi, 599 (1919)] to show that different plants were included under *E. Rothiana.* Unfortunately, Sedgwick ignoring Gage's species, identified *E. perbracteata* with *E. laeta* Heyne [in Roth, *Nov. Pl. Sp.,* 230 (1821)], an invalid binomial on account of the previous publication of *E. laeta* Ait. [*Hort. Kew*, ed. i, II, 141 (1789)], which is usually accepted as a synonym of *E. dendroides* L. Haines taking up *E. perbracteata* [*Bot. Bihar and Orissa*, ii, 145 (1921)] neglected in his turn Sedgwick's contribution. The outcome of these imperfect listings is that *E. perbracteata* is scarcely better known now than it was before 1914, a peculiar state of affairs considering that this spurge is one of the easiest to identify and has been twice described at length within five years.

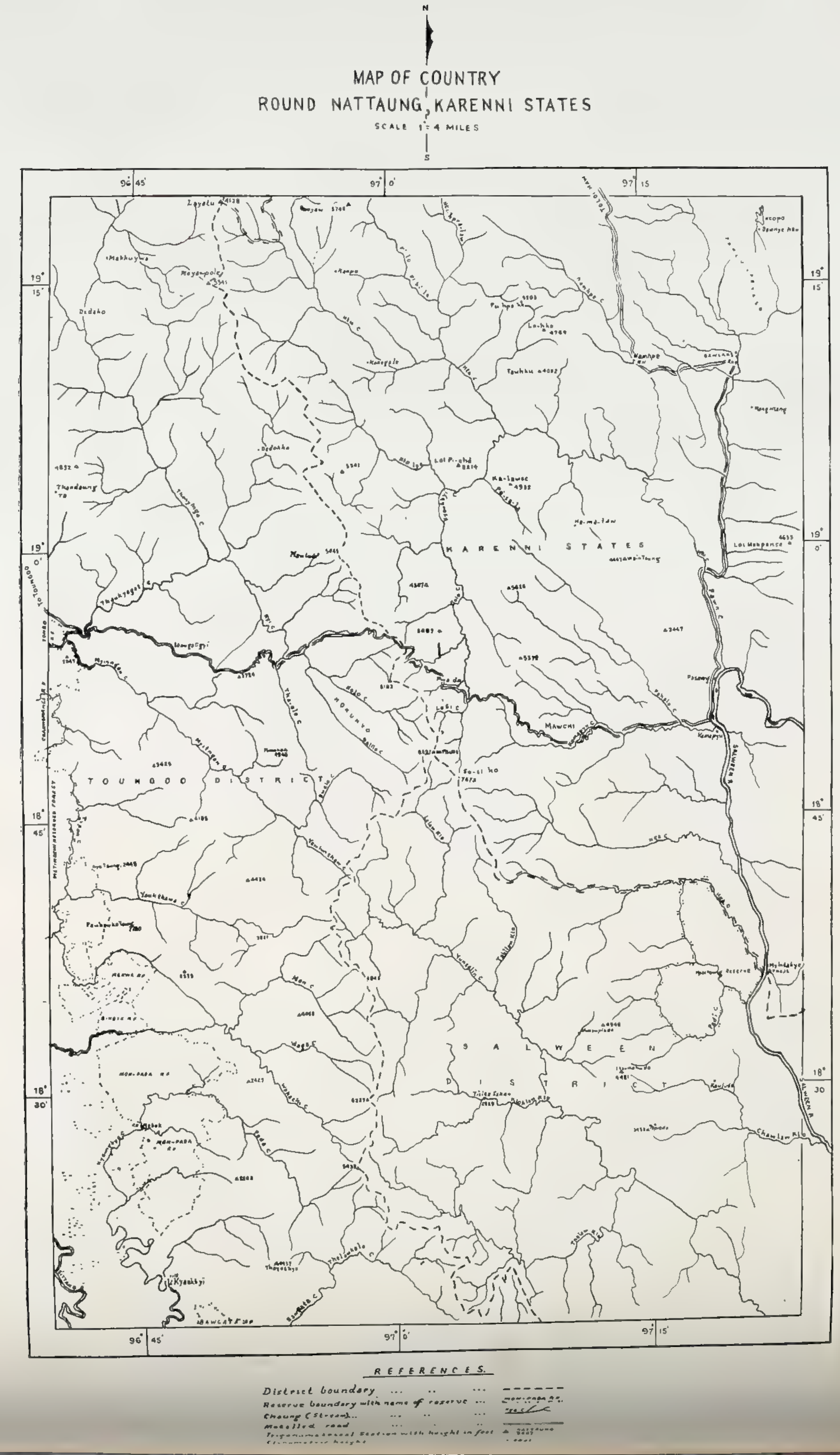
Sedgwick states it *always* has 3 rays at the umbellaster. Gage describes it as carrying 2-4 rays. These notes are not contradictory; Gage described few specimens only, and knowing that in *Euphorbia* the number of rays is variable figured out an average. Sedgwick wrote from direct personal observation. All the specimens which I have seen had 3 rays. In addition to this unusual and peculiar number of rays, *E. perbracteata* may be further characterized as follows; (1) the glands of the cyathium are neither horned nor smooth at the margin, but coarsely and irregularly toothed; (2) the bracts surrounding the cyathia are conspicuously veined, ribbed and often connate at the base; (3) the specimens in herbarium have a pale green colour, usually fewer leaves than *E. dracunculoides* and *E. Rothiana* and a manifestly annual root; (4) the seed appears to be intermediate between that of *E. dracunculoides* and *E. Rothiana*: it is more or less mottled and the testa is very nearly smooth. The seed of *E. dracunculoides* is roughened from an irregularly distributed thick whitish aril and is lacunose at the testa. The seed of *E. Rothiana* is grayish and smooth throughout.

Gage gives as range the United and Central Provinces; Sedgwick restricts the species to the region of Bombay and the Carnatic, stating, however, that its range is probably wider; Haines reports having collected it only in cultivated fields as a seemingly introduced weed, but cites it from Behar on the faith of Kurz. I believe at this time that the region of Bombay is the locality of India where this spurge is actually endemic because, as it has been stated, its affinities appear to lie in the direction of Persian endemics. More extensive collections are needed, however, to define the range and the affinities of this peculiar species. While Indian *Euphorbia* occurs in South-Western China, there in part native (e.g., *E. Rothiana, E. prolifera, E. Royleana*) and in part introduced as it seems (e.g., *E. dracunculoides*), I have never seen *E. perbracteata* collected outside of India. This limited distribution is peculiar in a weed of cultivation. I suspected at first that the species has definite edaphic preferences and a strictly winter-cycle of growth. This did not prove to be the case because seeds collected near Poona in February and sown in America in May, in the hothouse, germinated in less than one week, producing extremely vital seedlings, even sturdier than those of *E. dracunculoides* and *E. Rothiana*. Under the circumstances it is surprising to learn that *E. perbracteata* is unknown in the great majority of the herbaria: I stand under deep obligation to Prof. S. S. Kumar, Economic Botanist to the Government, Poona, who collaborated to my work with specimens and viable seeds.

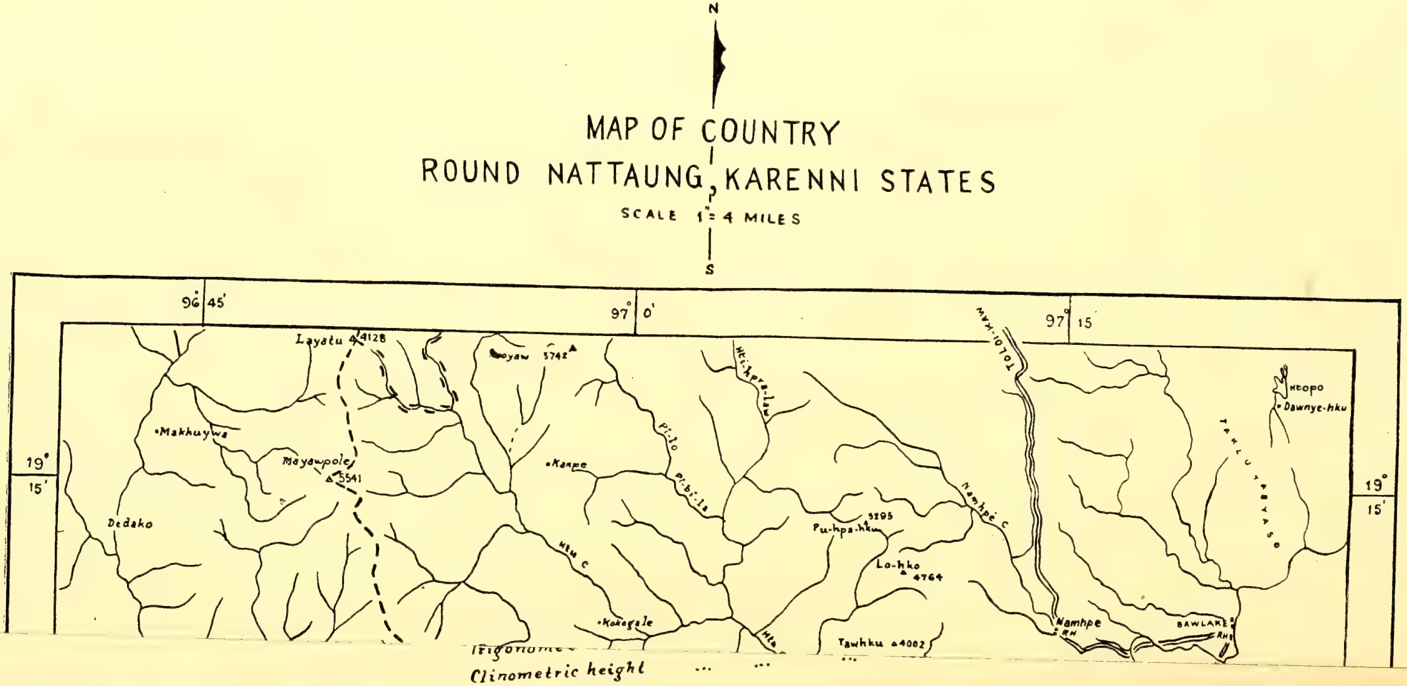
To conclude these notes it may be pointed out that Sedgwick is much misinformed in listing *E. Rothiana* Spr., of Sprengel, Syst., iii, 796 (1826) and Boissier in DC. Prodr. XV, ii, 156 (1862), as a synonym of *E. perbracteata* (*E. laeta* of Sedgwick, not of Aiton nor Heyne). I have seen numerous authentic specimens of *E. Rothiana* and *E. oreophila*, some bearing Boissier's own identification, not a single one of which is in any way representative of *E. perbracteata.*

MAP OF COUNTRY ROUND NATTAUNG, KARENNI STATES

SCALE 1" = 4 MILES


N
S
96° 45'
97° 0'
97° 15'
19° 15'
19° 0'
18° 45'
18° 30'
KARENNI STATES
TOUNGOO DISTRICT
SALWEEN DISTRICT
MAWCHI
Nattaung
SALWEEN R.
To Toungoo
REFERENCES.
District boundary ... .
Reserve boundary with name of reserve ...
Chaung (Stream)... ... .
Metalled road ... . ..
Trigonometrical Station with height in feet
Clinometer height

MAP OF COUNTRY
ROUND NATTAUNG, KARENNI STATES
SCALE 1" = 4 MILES


N
S
96° 45'
97° 0'
97° 15
19° 15'
19° 15'
Layatu 4128
Moyaw 5742
Makhuywa
Mayawpole
5541
Dedako
Kanpe
Pi-lo
Pi-bi-la
Hti-hpra-law
Tolol-kaw
Hlu c
Kokogale
Hta
Pu-hpa-hku
5295
Lo-hko
4764
Tawhku 4082
Namhpe c
Namhpe RH
BAWLAKE RH
Htopo
Dawnye-hku
TAKLU YABYASO
Trigonome
Clinometric height ... ...

NOTES ON THE BIRDS OF NATTAUNG, KARENNI.

BY

MESSRS. H. C. SMITH, M.B.O.U., P. F. GARTHWAITE, AND

B. E. SMYTHIES, Burma Forest Service.

With Systematic Notes by

DR. C. B. TICEHURST, M.A., M.R.C.S., M.B.O.U.

(*With a map*).

Description of the locality.—Nattaung (8,607 feet) is the highest point in Southern Burma on the Sittang-Salween divide. The boundaries of Toungoo District, Thaton District and Karenni meet on the summit (Lat. 18° 49′ North, Long. 19° 02′ East). The annual rainfall is not less than 110 inches, probably considerably more.

Below 5,000 feet shifting cultivation has been so extensive that the whole area consists of secondary growth of various ages and density, with pine, oaks and chestnuts predominating, and virgin forest is confined to a few precipitous gorges unsuitable for cultivation. Above 5,000 feet very little cultivation has been done, and virgin forest covers the area.

In what follows the nomenclature adopted is that used by Champion in 'A preliminary survey of the forest types of India and Burma', *Indian Forest Records,* Volume I, Number 1 (to which a reference is invited). Four climax types and two seral types occur on Nattaung.

1. (Group 1a C2) Eastern tropical evergreen = Evergreen.

This type occupies steep north facing slopes from 5,000 to 8,000 feet, and also occurs in moist pockets and along the streams in the other types. The following is an extract from Champion's description:

> 'Lofty, dense, evergreen forests 150 feet or more high. . . . the canopy is extremely dense . . . epiphytes are numerous . . . ground vegetation in typical cases may be almost absent, elsewhere a carpet of *Strobilanthes* or *Selaginella* and ferns may occur; grasses are absent . . .Erect bamboos are unusual but may occur locally'.

1a (E 9) Southern wet bamboo brakes = Bamboo brake.

This type occurs here and there in the preceding type. 'Bamboo brakes are usually found along streams or on badly drained hollows more or less displacing the tree forest . . . the brakes are often very dense, even if the bamboos grow in clumps'.

2. (Group 7b C3) Burma Sub-Tropical Hill Forest = Oak forest.

This type is a buffer between the pine forest and the evergreen; it grades into temperate forest (see below) at about 6,000 feet. 'Hill forest of good height and density, the dominant species being mostly evergreen though some large briefly deciduous trees occur. The total canopy density is much less dense than in the tropical evergreen and the large trees rarely stand close together. A shrubby undergrowth is always present and grass is absent. Bamboo may be present or not. The type is characterised by the prevalence of oaks and chestnuts, *Quercus* and *Castanopsis*.'

3. (Group 8 C2) Assam-Burma Pine Forest = Pine Forest.

This type occurs on south and east facing slopes from 4,500 to 8,000 feet, and covers large areas but is restricted to well drained soil. 'Typically a practically pure association of pine (*Pinus khasya*) but very generally considerably influenced by the annual or periodic fires which take place. Typically no other trees occur in the top canopy, there is practically no underwood, and even shrubs are few, but where moisture conditions are a little more favourable there tends to be an underwood of *Quercus* and other broad-leaved trees. These trees, mostly evergreen species, increase with rising altitude leaving the pine on the warmer, drier ridges and as scattered standards. A grassy soil cover is usual . . . climbers and bamboos are absent'.

3a. (2S/2) Burma subtropical hill savannah = Savannah.

'Grassy downs with scattered clumps or single trees usually pine and oaks'.

This type only occurs as a small area of a few acres on the top of Sosiko.

4. (Group 10b C2) Assam-Burma wet temperate forest = Temperate forest.

The higher slopes of Nattaung, above about 6,000 feet are covered by this type, with a few outliers of pine forest and evergreen; it is like a dwarf form of oak forest with which it intergrades, and is distinguished by low rounded crowns and short boles, dense bamboo undergrowth (*Arundinaria elegans* Kurz), and alpine elements in the flora.

> 'Closed evergreen high forest of trees of large girth but medium height, rarely over 80 feet, and usually with large branching crowns festooned with mosses and larger epiphytes . . At the high elevations a dwarf bamboo undergrowth is very generally developed and may be very dense and uniform over large areas'.

Oak and chestnuts are prevalent; *Rhododendron* occurs in the pine forest outliers over 7,000 feet.

The period spent on Nattaung was from April 8th to April 16th. The locality was reached by lorry from Toungoo in eight hours by the road recently opened by the Mawchi Mines Company. The first camp was at mile 82, ten miles over the Karenni boundary at about 5,000 feet; from here the lower slopes were worked and a general survey of the locality made. After three days a move was made with cooly transport over a thousand foot ridge to a camp on the Lesi chaung, at about 5,000 feet, from which the summit (8,607 feet) could be reached in about three hours steady climbing. From this camp also Sosiko (7,571 feet) was visited, a climb of seven hours along the eastern watershed of the Kolo chaung. Possible camping sites nearer the main ridge were noted, from which the higher elevations could be worked with greater ease.

The time spent on the mountain was short, and new records were still being obtained on the last day, so that the birds recorded below can only be an incomplete list of the avifauna.

Dr. C. B. Ticehurst, to whom we are greatly indebted, has identified all the skins, and his systematic notes and remarks appear in square brackets at the end of each form.

[The first collection to be made in Karenni was in 1861 when Major Lloyd travelled through the country. His birds were said to have gone to the East India Company's Museum in Calcutta and so far as we know have never been reported on. In 1874 Wardlaw-Ramsay accompanied Major Lloyd on an expedition to the capital of Karenni, Kyai-pho-gyee (Kyebogyi). The expedition entered the Karen Hills from Toungoo on March 5, and after a halt at the capital for a week and a visit to the Shan frontier it started to return on March 30, crossing he Karen Hills 50 miles north of the outward journey and reached Toungoo on April 10. The highest elevation reached on this trip was 6,000 feet. The collection of 400-500 birds of about 150 species is in the British Museum. Ramsay wrote a short account of the trip (*Ibis* 1875, pp. 348-353) but the exact itinerary and a full list of birds was never published. A brother officer of Ramsay spent some weeks in the hills at 3,000-7,000 feet in April and May and gave such birds as he collected to Ramsay and it was no doubt this officer who visited Nattaung which is mentioned as a locality that *Siva strigula* was obtained at in a further paper Ramsay wrote on Burmese birds (*Ibis* 1877, pp. 452-473). Ramsay also sent his collector into Karenni and it was he who first obtained *Sitta magna*. Other new birds were described in short notes by Walden and by Ramsay either from Karenni or the Karen Hills. All the information on Karenni was, of course, incorporated in Oates' *Birds of Burma*.

So far as we know no one since then has done any collecting in Karenni; from December 1877 to April 1888, and from May 1888 to December 1888 Leonardo Fea toured in the Karen Hills near the Karenni boundary; his collecting places being Leito (Leiktho), 30 miles N.-E. of Toungoo; Yado, 30 miles N.-E. of Leito; Taho, 8 miles north of Yado and Chialla 25 miles N.-E. of Taho. His collection contained 467 specimens of 165 species; eight were described as new and five new to Burma. Salvadori gave a full account of it. (*Ann. Mus. Cir. Genoa—Ser.* 2, Vol. vii, 1889). Since then various Englishmen have been in the Karen Hills at Thandaung, but no connected account of the birds has been written. Farther south Davison collected round Papun and Kyaukhnyat and his birds were reported on by Hume in his 'Birds of Tenasserim' (*Stray Feathers*, Vol. vi, 1878).]

Corvus macrohynhcus.

A few birds seen near human habitation between 5,000 and 6,000 feet.

Dendrocitta formosa subsp.

Occasionally heard in the pine forests about 5,000 feet.

Parus major subsp.

Birds seen on several occasions in clearings and in pine forest.

Machlolophus spilonotus subviridis.

3 ♂ ; 2 ♀.
Frequents oak and pine forests between 5,000 and 7,000 feet. Not seen above this elevation nor in evergreen. Has a pleasant little song. Seen on many occasions in parties working through high undergrowth or in the crowns of low pines; not uncommon.

Aegithaliscus concinnus pulchellus.

1 ♂ ; 1 unsexed.
Seen on two occasions in parties working through long grass and secondary growth on a steep hillside near the Mawchi road at 5,500 feet. Another party was seen working rapidly through the crowns of low pines on the edge of cultivation at 5,000 feet.

Suthora poliotis feae.

1 ♀.
Specimen obtained in dwarf bamboo at 8,000 feet on the final slope of Nattaung. One other bird was seen, in regrowth at 4,500 feet, working through the bushes like a *Phylloscopus*. Does not appear to be such a skulker as described in *F. B. I.*

[This single specimen agrees with the description of *feae*. From *ripponi* (Mt. Victoria) it differs in having the white moustache smaller and in having the breast grey, dividing the black throat from the ochraceous underparts. It was described by Salvadori from Taho in the Karen Hills and has not since then been met with. I do not know on what grounds Fort Stedman is given as a locality for this bird in the *Fauna*, ed. ii; there are no specimens in the British Museum and no records from Fort Stedman.]

Psittiparus gularis gularis.

3 ♂ ; 2 ♀.
Common in shrubs and understorey trees in oak and pine forests between 5,000 feet and 6,000 feet. Not seen in evergreen. A pair of very excited birds observed at close quarters in pine forest on a ridge top at 6,000 feet behaved as if they had a nest close by. Has a harsh chattering note.

Sitta magna magna.

1 ♀.
Shot in pine tree at 5,500 feet. Seen on one other occasion in pine forest. Has a distinctive tri-syllabic call, like the cough of an angry gibbon.

Sitta frontalis corallina.

1 ♂ ; 1 unsexed.
Fairly common in the oak and pine forests up to about 6,000 feet.

Garrulax moniliger.

Seen in evergreen at about 5,500 feet.

[In the British Museum there are specimens from Karenni and these are intermediate between *moniliger* and *fuscata*.]

Trochalopteron erythrocephalum ramsayi.

4 ♂; 4 ♀.

The common Laughing-Thrush of these forests, being found in all types where undergrowth is heavy. It is particularly partial to bamboo brakes in evergreen. Has a loud call 'wee-ou-wee-whip', the last note higher and louder.

[Mr. Deignan (*Proc. Biol. Soc.* Washington, Vol. LI, pp. 87-92, 1938) in dealing with the southern group of the Red-headed Laughing-Thrushes unites *ramsayi* with *melanostigma* on the grounds that the species is very variable, that the characters of *ramsayi* are not constant and that *ramsayi* has no geographical range. He further states that it would seem that Ogilvie-Grant selected from the series those that suited his purpose, i.e., fitted with his description of *ramsayi.* In the British Museum there are six or eight specimens from Karenni, Karen Hills, Byingyi Mt. in Loi Long, Pine Forest of Salween (which means Kyaukhnyat district) and Yengyi Palaung in Lauksawk; in addition there are available two from Byingyi and eight from Nattaung.

The first thing that strikes one on assembling these is the constancy of the characters of *ramsayi.* Assembled with a series of *melanostigma* from Mt. Muleyit in Tenasserim the two series stand out in marked contrast. Ogilvie-Grant was right in separating them and the supposition that he picked specimens to suit his ideas is insupportable. The second noticeable thing is that all these *ramsayi* come from the very definite area of the Sittang-Salween watershed, with the possible exception of Yengyi Palaung which I have not been able to localize. This area, I may remark, is rather notable for the peculiar and local races it supports—*Leioptila m. castanoptera, Leioptila m. saturata, Siva cyanouroptera oatesi, Suthora poliotis feae, Ixulus humilis clarkii, Aethopyga nipalensis karenensis* are some of them—and so there is nothing remarkable in finding a recognizable race of this *Trochalopteron* there. That odd birds resembling *ramsayi* may occur outside its range does not negative the validity of the race when 100% *within* the range are recognizable.

In this series the upper parts are greyish-olive with just a tinge of rufous on the hind collar; the chestnut of the throat is extended down over the breast and belly in a paler tint between Ochraceous Tawny and Ochraceous Orange (Ridgway XV). Only the flanks are olive and even these are tinged with the same colour.]

Trochalopteron ripponi.

1 ♂; 1 ♀.

The two specimens were obtained in oak and pine forest near the top of a ridge at about 6,000 feet. Not nearly so common as the Red-headed Laughing-Thrush.

[Though said to be the commonest Laughing-Thrush of the Southern Shan States, the occurrence in Karenni is an extension of range farther south.]

Pomatorhinus olivaceus subsp.

Seen and heard frequently in regrowth at about 5,000 feet.

[No form is recorded from Karenni and specimens would be highly desirable; *olivaceus olivaceus* is the form of N. Tenasserim; in Southern Shan States *ripponi* occurs, so the form in Karenni must remain doubtful at present. The relationship, too, of the group to the *schisticeps nuchalis* group requires much further careful collecting; it may be that, though both certainly occur close together, *olivaceus* is the high elevation form. *P. nuchalis* was described from Thayetmyo.]

Pomatorhinus erythrogenys imberbis.

2 ♂.

In pine forest at 6,000 feet. Two were shot out of a party of *Turdus obscurus.* No other records.

Pellorneum ignotum cinnamomeum.

1 ♂.

Shot in grasses in regrowth on top of a pine ridge, near the ground. One of a pair.

Napothera brevicaudata venningi.

1 ♀.

Two birds seen together in the bed of a rocky stream in evergreen (with pines just above) at 5,000 feet. The bird seemed very excited and perched on a low branch making a noise like the two described under No. (225) in the *F. B. I.* No other birds of the kind seen.

[The type of *brevicaudata* came from Muleyit and *venningi* from the 'Southern Shan States'. It was obtained by Craddock on 23 March 1902, and no further locality was specified. Craddock was, however, on Loi Mai in Mongpawn on 7 April 1902 so that *venningi* probably came from near there. On Byingyi in Loi Long State *venningi* occurs, so that its extension now to S.-W. Karenni is an addition to our knowledge.]

Stachyris chrysaea assimilis.

1 ♂; 1 ♀; 1 unsexed.

Fairly common both in regrowth and also in the undergrowth in evergreen, often associated with parties of *Alcippe*.

Stachyridopsis rufifrons rufifrons.

1 ♂.

Obtained in bamboos in oak forest at 6,000 feet. The only bird seen.

Alcippe fratercula fratercula.

4 ♂; 3 ♀; 2 unsexed.

Very common at all elevations above 5,000 feet in all types of forest.

Schoeniparus dubius dubius.

2 ♂; 1 unsexed.

Seen on many occasions in low, dense undergrowth or grasses between 5,000 feet and 7,000 feet in all types of forest. A great skulker. A chattering note 'chit-chit-chit-chit' constantly repeated and also a distinctive call note 'chee-chee-chee-chee-chee-chee-hpwit'. Almost certainly nesting.

[The type came from the outskirts of pine forest above the Salween and this must have been in the Papun-Kyaukhnyat area which may be fixed as the type locality. It has not been recorded from Karenni before and is a useful extension of range, as in the Southern Shan States the form is *intermedius*.]

Pseudominla castaneiceps castaneiceps.

3 ♂; 2 ♀; 1 unsexed.

Found chiefly in temperate forest above 6,000 feet; but occasionally seen in other types. They are confiding little birds and allow a close approach. In habits they are arboreal, climbing about moss- and lichen-covered trees and climbers. Do not ascend up into the crowns of the trees but work the trunks up to about 30 feet. They run up and down, under and round branches rather like Nuthatches do. Quite common.

Heterophasia picaoides cana.

1 ♂.

Obtained at 6,000 feet in oak and pine forest out of a party of about 6 birds. The call is a loud whistle 'Whee-whee-weeou-weou', the last two notes dropping in pitch.

[I have recently been able, through the kindness of Mr. Deignan, to examine a topotype series of *cana* and I must confess I see no difference. In describing *burmanica* I was misled by the description of *cana* and the fact that the only *cana* available to me *were* paler than Indian birds. The characteristic feature of the form, however, is the shorter tail, not the pallidity of the underparts, as I pointed out in describing *burmanica*.]

Leioptila melanoleuca castanoptera.

2 ♂.

The distinctive mournful call of this bird, 5 notes on a descending scale in a minor key 'whee-ou-hoo-hoo-hoo', was heard all over these forests from 5,500 feet upwards. A low chattering note is also uttered while feeding. This was the only species obtained or seen.

[The type of *castanoptera* was obtained by Fea about 60 miles N.-E. of Toungoo in the Karen Hills. It is a bird of very limited distribution. The northernmost locality is Kalaw and the southernmost is the present one at Nattaung. It is evidently, like some other forms, confined to the hills dividing the Sittang from the Salween valleys.

That there has been some confusion of the forms of this species is hardly to be wondered at; *melanoleuca* was described in 1859 from Mt. Muleyit, N. Tenasserim. In *Stray Feathers*, Vol. vi, p. 294 Hume gave a minute description of this form. He says . . . 'ear-coverts black in some specimens with a slightly browner tinge . . . central tail feathers narrowly, the rest broadly tipped with pure white,. . . back, scapulars, lesser and median coverts a deep, somewhat chocolate brown.' In 1889 Salvadori described *castanoptera* from the Karen Hills which differed from *melanoleuca* chiefly in having the greater coverts and most of the tertials chestnut instead of black. In the *Fauna*, Ed. ii, Stuart Baker called attention to two birds in the British Museum from N.-E. Central Burma with upperparts black and named the form *radcliffei*. To be more precise one came from Kyetpyin near Ruby Mines (and is the type) and one from 'My Pai Hill, Salween'.

Finally de Schauensee in 1929 named a form from N. Siam as *laeta* which was said to have the ear-coverts dull black, the colour of the back different to that of *melanoleuca* and *radcliffei* and to have the tips of the four central tail feathers rather dark grey. The author apparently did not compare his specimens with specimens of *melanoleuca* and *radcliffei* and was misled by relying on descriptions only,—always a somewhat risky procedure.

To deal with each form in detail; *castanoptera* can be dismissed in a few words. It seems to be a perfectly valid form of very limited distribution extending along the edge of the Shan plateau from Kalaw in the north to Nattaung in the south. It certainly is a local race of *melanoleuca* and not a species, as has been stated, as I find that single specimens of *melanoleuca* from the hills east of Fort Stedman have just a trace of the chestnut markings of *castanoptera*. I think there can be no doubt that *melanoleuca, radcliffei* and *laeta* are all one form; *laeta* can be dealt with quite shortly as through the kindness of Mr. H. G. Deignan I have been able to compare freshly obtained birds from Siam with recently collected specimens from the Ruby Mines (*radcliffei*) and the two series are precisely the same. The supposed differences between *melanoleuca* and *radcliffei* are explained by fading. Recently collected birds from Taunggyi in Southern Shan States are *radcliffei*, one collected there some years ago is now *melanoleuca*, as are others from Southern Shan States of equal date. One collected in 1923 at the Ruby Mines was identified at the British Museum in the same year as *radcliffei;* it is still there and today is *melanoleuca*.

I may note that Hume was not too precise in calling the tips of the central tail feathers pure white; in the specimens he examined the tips of the four central tail feathers were almost worn off; what is left of them is grey, not white like the tips of the laterals. He called the ear coverts black, in some slightly brown; fading has gone further since then and all the Muleyit specimens now have brown ear coverts. The mantle changes colour with time. Fresh specimens are almost black (*radcliffei*), old specimens have a varying chocolate tinge in proportion to their age in the cabinet.]

Actinodura ramsayi ramsayi.

3 ♂; 2 ♀.
These birds are common in regrowth in oak and pine forests between 4,500 to 6,000 feet. They have a trisyllabic call 'wee-oo-wee', the middle note lower in pitch and reminiscent of the call of Abbott's Babbler. One bird was watched while uttering a 4-note call 'Pee-ou-peee-peee', the last two notes long and rather wailing like the call of a Kite.

Staphida striata striata.

1 ♂; 2 ♀.
Found in thick undergrowth in oak and pine forest between 5,000 feet and 6,000 feet. They go about in parties, sometimes associating with *Alcippe*. Have been seen hanging upside down on twigs like Tits.

[Known from Byingyi, Karen Hills and N. Tenasserim so that its occurrence now in Karenni was to be expected. On the other hand birds from Thandaung a little farther north are nearer *rufigenis.* Further specimens in this area are desirable.]

Siva strigula castaneicauda.

5 ♂; 2 ♀; 2 unsexed.

Common in temperate forest above 6,000 feet. Keep to crowns of trees. Not shy birds.

[The type of *castaneicauda* came from 'Hill Tenasserim' by which was meant Mt. Muleyit. On the small material available it has been rather questionable how much the dullness of *castaneicauda* was due to fading compared with *strigula.* But these fresh specimens show that this dullness is a subspecific character; both *strigula* and *yunnanensis* are richer yellow below and more golden on the crown; in *castaneicauda* the bill is larger and the chestnut of the tail seems to be paler than in *yunnanensis* and more extensive than in *strigula.*]

Ixulus humilis clarkii.

1 ♂; 2 ♀.

Parties of 4 or 5 birds seen in pine forest at about 6,000 feet. The birds utter a low 'chuck-chuck' while working through the branches, now and then uttering a 'chir-chir-chir-chir' note. Parties also seen working through secondary growth on steep hillsides near the Mawchi road. One party seen was associated with a party of *Aegithaliscus concinnus.* Erected crests and moustachial streaks show up well in the field.

[This form was hitherto known only from the type locality Byingyi Mt. in Loi Long so that its extension now to the S.-W. corner of Karenni is of interest. It is evidently another of the forms peculiar to the Sittang-Salween divide.]

Herpornis xantholeuca xantholeuca.

2 ♂.

Obtained in pine forest at 6,000 feet where these birds were occasionally seen.

[Not previously recorded from Karenni, though to be expected, as it occurs in Southern Shan States, Karen Hills and N. Tenasserim.]

Cutia nipalensis nipalensis.

2 ♀.

Both specimens obtained on the same open pine ridge at about 6,500 feet. They keep to the tops of trees and utter a loud monotonous 'piou-piou-piou-piou . . . . .' repeated 6 to 12 times.

Pteruthius erythropterus aerulatus.

3 ♂; 1 ♀.

Found chiefly in oak and pine forest between 5,000 feet and 6,000 feet, but a specimen was also obtained in temperate forest at 8,000 feet. The call of this bird as it works through the tops of pines or oaks is one of the distinctive noises on Nattaung. The call is a loud and mellow 'cha-chew, cha-chew'. One specimen was obtained as it was hopping sideways along the branches of an oak uttering a different call, tri-syllabic in an ascending scale, the first syllable longer than the others. Males appear to predominate in the population, perhaps because they are easier to see.

[These are nearer *aerulatus* than to *yunnanensis.*]

Mesia argentauris.

2 ♂.

Common in regrowth about 5,000 feet. Often associated with parties of *Alcippe.* They utter a chattering note.

Minla ignotincta.

3 ♂; 1 ♀; 2 unsexed.

Two obtained above 6,000 feet, both in open pine forest and also in temperate forest. Not a shy bird. Keeps to the crowns of trees going about in small parties.

[The occurrence of this bird in Karenni is a large extension to its known range; the nearest known places where it occurs in Burma are Mt. Victoria in the Chin Hills and the hills east of Bhamo.]

Microscelis psaroides concolor.

1 ♀.

Fairly common in pine forests about 5,000 feet. A bird of the tree-tops.

Ixos maclellandi tickelli.

1 ♂; 1 ♀.

Common in evergreen between 5,500 and 7,000 feet, and also in pine and oak forest near secondary growth.

[The distributions of *tickelli, binghami,* and *similis* in eastern Burma require much further study and further collecting is essential.]

Alcurus striatus.

3 ♂; 1 unsexed.

Found in both pine and evergreen above 6,000 feet. Has a number of calls; one bird was shot making a tri-syllabic call with a drop in the middle—'whee-too-wheet'. Keeps much to the tops of tall trees.

[Known from the Karen Hills and Southern Shan States but not hitherto from Karenni.]

Molpastes chrysorrhoides klossi.

1 unsexed.

Only one pair seen, in shrubs on pine ridge at 5,000 feet.

[I keep this form as a race of *chrysorrhoides* for the time being; the relationships of *klossi, nigropileus* and *burmanicus* and their distributions require a great deal of further careful collecting. In some localities two of these forms appear to live side by side, but from all localities in the hills material is utterly inadequate; *chrysorrhoides* is a Chinese form and does not occur in Burma so far as we know.]

Xanthixus flavescens vividus.

2 ♂; 1 unsexed.

The common Bulbul of the re-growth and forests below 5,000 feet. Many young birds on the wing were seen.

Pycnonotus jocosus (Linn.).

Common in re-growth and low forest up to 5,000 feet.

Pycnonotus flaviventris flaviventris.

1 unsexed.

The only bird seen, shot in re-growth at 4,500 feet, which must be near the upper limits of this species.

Certhia discolor shanensis.

1 ♂; 2 ♀; 1 unsexed.

Commonly seen both in the pine forests and also in evergreen from 5,000 feet upwards, but most often in the pines. The note is a shrill loud 'duwee-teet'. It is not a shy bird and appears so absorbed in its hunt for insects in the bark that it allows a close approach.

Pnoepyga pusilla pusilla.

1 ♂.

The only specimen seen. Was obtained in the undergrowth in evergreen near a stream at 6,000 feet.

Tesia cyaniventer.

1 ♀.

Obtained in the same place as *Pnoepyga* at 6,000 feet. It was uttering its characteristic shrill 'chirrup' which betrayed its presence.

[Recorded from Karen Hills and Mt. Byingyi but not before from Karenni. This specimen belongs to the form *olivea.*]

Brachypteryx cruralis.

3 ♂; 1 unsexed.

All the specimens were obtained in evergreen undergrowth at about 7,000 feet. No females of this species were seen, though 2 of the males shot were together.

Brachypteryx nipalensis nipalensis.

2 ♀; 1 unsexed.

Two specimens obtained in thick evergreen undergrowth near a stream at 5,500 feet and one in grasses in re-growth at 5,000 feet. No males seen.

[Hitherto Kalaw is the only locality where this species has been obtained between Bhamo in the north and Tenasserim in the south. I have already given reasons for uniting *Heteroxenicus* with *Brachypteryx* (*Ibis.* 1939, p. 349).]

Saxicola caprata burmanica.

Pairs seen along the road in re-growth at about 5,000 feet. No specimens obtained.

Rhodophila ferrea ferrea.

2 ♀.

Common in the open pine forests up to 7,000 feet.

Henicurus schistaceus.

1 ♀.

Shot in a stream at 5,000 feet in pine forest and found where the streams flow through rather open country, as opposed to evergreen.

[Though known from the Karen Hills this has not been recorded before from Karenni.]

Henicurus leschenaulti indicus.

1 ♂.

These birds take the place of the Slaty-backed Forktail in the higher reaches of the streams above 6,000 feet where they run through evergreen.

[This also has not been obtained actually in Karenni before, though it has been in the neighbouring states.]

Chaimarrornis leucocephalus.

Birds seen in rocky streams at about 5,000 feet in several places. Undoubtedly breeds here. Two birds seen together at a big waterfall on the Mawchi road at 5,000 feet.

[A slight extension of range southwards from the Southern Shan States where it occurs.]

Calliope calliope.

A male seen in thick re-growth at about 4,500 feet.

Turdus obscurus obscurus.

1 ♀.

Specimen obtained out of a party of 15 to 20 birds feeding on ground in open oak forest at 6,000 feet. Also seen in evergreen. When approached all the birds flew swiftly up into the tops of the nearby trees with thin Pipit-like calls of 'zip-zip'. In habits this thrush resembles the Redwings and Fieldfares rather than the Gorund-Thrushes.

[I have already dealt with the question of *subobscurus* which Salvadori described from the Karen Hills (*Ibis.* 1935, p. 255). Wardlaw Ramsay obtained *feae* in Karenni and probably this and *obscurus* occur together in mixed flocks as winter visitors.]

Oreocincia dauma dauma.

1 ♂.

Obtained in oak forest at 6,000 feet, the only bird seen. It was working through the shrubs and lower branches 10 to 15 feet from the ground. The white wing bar is a good field character.

[Has been recorded in the Karen Hills.]

Zoothera marginata.

1 ♀.

Flew up into a sapling from the bed of a stream in which it was apparently feeding in evergreen at 5,000 feet. The only bird of its kind seen.

Monticola rufiventris.

A male bird seen, but not collected, in pine forest at 5,000 feet. Sat very erect and still on a dead branch high up in the crown of a tree. Observed clearly through the glasses for nearly half an hour.

Myophoneus eugeni.

1 ♀.

Seen in several of the rocky streams in oak forest at 5,000 feet.

Hemichelidon sibirica fuliginosa.

3 ♀.

Shot just below the top of Nattaung at 8,500 feet in dwarf bamboo. Not uncommon in pine and oak forest at 5,000 feet. Partial to dead trees standing in clearings from which it hunts.

[Has been obtained in the Karen Hills as late as 26 April. The status is uncertain.]

Hemichelidon ferruginea.

1 ♂; 3 ♀; 1 unsexed.

A very common Flycatcher along the streams in evergreen between 5,000 feet and 7,000 feet, and also found in more open country.

[Has been obtained in Southern Shan States and Tenasserim, but not hitherto in Karenni. Here again the status is uncertain as to whether it is a winter visitor or resident.]

Muscicapula hodgsoni.

1 ♂; 2 unsexed.

Found commonly in all types of forest between 5,000 feet and 8,000 feet. The male has a few (2 to 6) white feathers behind the eye on the sides of the crown.

Muscicapula hyperythra hyperythra.

1 ♂; 1 ♀.

Obtained near stream in evergreen about 6,000 feet and in temperate forest at 8,000 feet.

[The nearest locality to Karenni that this bird has been obtained is the Southern Shan States. Status uncertain.]

Muscicapula melanoleuca melanoleuca.

2 ♂; 3 ♀; 1 juvenile.

Common in open oak and pine forest between 5,000 and 6,000 feet. The note is a thin high 'Pi-pi-pi-pi' followed by a low rattle 'churr-r-r-r-r-' or 'Pi-churr-pi-pi-pi-pi'.

Musicapula sapphira.

1 ♂.

In open pine forest at 5,000 feet. Another male was seen in thick regrowth at 5,000 feet.

[Does not appear to be common anywhere. It has been obtained in the Southern Shan States once or twice.]

Eumyias thalassina thalassina.

Seen on several occasions in re-growth at about 5,000 feet.

Culicicapa ceylonensis calochrysea.

Seen on numerous occasions up to 6,000 feet in all types of forest.

Niltava grandis grandis.

3 ♂; 1 ♀.

Seen and heard in many places up to 7,000 feet. It keeps to evergreen, particularly near streams and works the lower storey 10 feet to 50 feet from the ground. The note is most characteristic, a loud whistle of 3 notes on an ascending scale in a minor key.

[Not previously recorded from Karenni, though it occurs as near as Mt. Byingyi in Loi Long State.]

Niltava macgrigoriae.

1 ♀.

Collected on stream bank on edge of hill cultivation in pine forest at 5,000 feet.

Chelidorhynx hypoxanthum.

1 ♂; 1 ♀; 1 unsexed.

Seen on several occasions in evergreen glades near streams at about 6,000 feet. It allows a close approach and flits about the branches, flirting out its tail like a Fantail Flycatcher. Two of the specimens were collected in temperate forest at 8,000 feet while courting.

[Recorded from the 'Toungoo Hills' by which probably was meant the Karen Hills near Thandaung.]

Rhipidura albicollis.

1 juvenile.

Several pairs seen at about 5,000 feet, and occasionally found up to 7,000 feet. It has a thin high-pitched whistle of 7 or 8 notes up and down the scale.

Lanius colluroides colluroides.

1 ♂.

Collected in pine forest at 4,500 feet, the only one seen.

Lanius nasutus tricolor.

1 ♂; 1 ♀.

Shot in re-growth at 4,500 feet where several birds were seen.

[The range of this species is still little known. It breeds at Kalaw and probably it breeds in Karenni, whence it has not been recorded before, though it has been taken in the Karen Hills in April.]

Tephrodornis gularis pelvicus.

1 ♂.

Obtained in pine forest at 5,000 feet.

[Known from the Karen Hills but not hitherto from Karenni. This single bird with wing 123 mm. is as large as any Burmese or Sikkim examples.]

Pericrocotus speciosus elegans.

1 ♂.

Seen once or twice at about 5,000 feet.

[This specimen is in the curious orange-red plumage sometimes found in Minivets. It is sexed as a male.]

Pericrocotus brevirostris.

3 ♂; 1 ♀.

The common Minivet of Nattaung, being found all over the open forest between 5,000 and 6,000 feet.

[Males from Karenni measure wing 85-89·5 and are therefore somewhat intermediate between *affinis* (87-93 mm.) and *neglectus* (81-86 mm).]

Pericrocotus solaris.

3 ♀.
Collected in pine forest at 5,000 feet, the only birds of this race seen for certain.

[These appear to be very worn *solaris* though I cannot match them with any other specimens. At the same time *ripponi* does not appear to me to be a recognizable race as none of the specimens from the Southern Shan States either accord with the description or differ from *solaris.*]

Graucalus macei siamensis.

Common in the pine and oak forests, about 5,000 feet.

Artamus fuscus.

1 ♂.
Common up to 6,000 feet particularly on top of pine ridges.

[The ecology of this bird, which appears to have some relationship to palms, needs more careful working out. It is local and capricious for which there must be some cause. It is said to feed on butterflies, including 'noxious' ones; why, then, the massive bill? Recorded from Southern Shan States but not from Karenni.]

Chaptia aenea aenea.

1 ♀.
Occasionally seen in valleys about 5,000 feet. Not seen on higher ridges.

Bhringa remifer tectirostris.

Seen on several occasions near the clearings for cultivation between 4,500 and 5,500 feet.

[Has been recorded from the surrounding districts but not from Karenni.]

Tribura sp?

A bird making a 'tschik-tschik' note was heard in savannah on Sosiko at 7,000 feet, but refused to show itself.

Franklinia gracilis Hodgsonii.

1 ♂.
Seen in re-growth and grasses about 5,000 feet, and in paddy stubble and bushes.

Scicercus burkii tephrocephala.

1 ♀; 1 unsexed.
Both obtained in oak forest at 6,000 feet, the only specimens seen.

[Not recorded before from Karenni, but it is known from the Karen Hills.]

Phyllergates cucullatus coronatus.

1 ♂; 1 unsexed.
A bird of dwarf bamboo brake, one specimen being obtained at 7,000 feet and the other at 8,500 feet. It has a very distinctive phrase of 4 notes, 4 times repeated each time about half an octave higher, the last so high as to be almost inaudible. 'Pee-pi-pi-pee' 4 times. The bird is most elusive. It has also a trilling little song, during which it flutters on a branch.

Phylloscopus pulcher pulcher.

3 unsexed.
Shot on top of main Nattaung ridge at 8,000 feet in dwarf bamboo.

[This Warbler has long been known in Southern Shan States and Karenni in April, but we still do not know whether it is a winter visitor or a resident.]

Phylloscopus inornatus inornatus.

2 ♀; 2 unsexed.

Phylloscopus are common in the low trees throughout, and are one of the few genera seen in the dwarf bamboos on the final ridge at 8,500 feet.

Phylloscopus reguloides assamensis.

2 ♀; 2 unsexed.

Found in the same localities as *P. inornatus.*

[Judging by the condition of the plumage I should say that these, too, were breeding birds. Many have at one time or another met with both this species and with *davisoni;* as yet there is no record of what the songs and call-notes are like.]

Phylloscopus reguloides claudiae.

1 ♂.

[In contradistinction to the somewhat worn dress of *assamensis* this bird, which is, of course, a winter visitor to Karenni, was in full body moult.]

Phylloscopus davisoni davisoni.

3 ♂; 1 ♀.

[This warbler is known to breed on Byingyi in March. Also at Kalaw and Thandaung and it certainly must have been breeding in Karenni.]

Suya superciliaris superciliaris.

1 ♂; 2 ♀.

Obtained in re-growth at 5,000 feet and also in grass on open pine ridge at 6,000 feet. It has a strong shrill double note 'tu-wut, tu-wut'. Almost certainly nesting.

[Also known from the Karen Hills.]

Oriolus chinensis subsp.

Seen on Mawchi road at 4,500 feet uttering a curious call 'Miaow' like a peevish cat.

Oriolus traillii traillii.

1 ♂.

Obtained in evergreen at 6,000 feet; one other was seen.

Carpodacus erythrinus roseatus.

2 ♀.

Seen in pine and oak forest on the edge of secondary growth at 5,000 feet, and a party of about six in female dress in pine forest at 6,000 feet.

Hypacanthis spinoides ambiguus.

1 ♂; 2 ♀.

A party in a cultivation clearing at 5,000 feet and seen on other occasions in pines at the same altitude keeping to the crowns of the trees. A distinctive, high-pitched thin call, 3 notes in quick succession followed by 4 notes in quick succession.

[Is known to breed at Kalaw and it occurs in the Myitkyina Hills. It must breed early as the specimen obtained on 8 April is a juvenile with fully grown wings.]

Delichon urbica subsp.

A large flock was seen hawking insects over pine forest at 5,000 feet in the smoke of a forest fire. Probably on passage.

Motacilla cinerea melanope.

1 unsexed.

Fairly common on the Mawchi road at 5,000 feet, frequenting places where little streams jet on to the road. No other Wagtails seen.

[The question whether the Grey Wagtail nests in the Burmese hills is still unsolved. Known from the Karen Hills, but not before from Karenni.]

Anthus hodgsoni hodgsoni.

4 ♀.

Very common in parties along the ridges in open pine and oak forest up to 7,000 feet.

[These belong to the Siberian form which is the typical race. Not previously from Karenni, but is almost universally distributed in the non-breeding season in Burma.]

Zosterops palpebrosa subsp.

1 ♀.

Obtained out of a pair in re-growth at 4,500 feet.

[*Zosterops mesoxantha* was described from Taho in the Karen Hills by Salvadori and this specimen is practically a topotype. It has a tinge of yellow down the middle of the belly as Salvadori describes. However, as I pointed out some years ago, such specimens are also found in Sikkim and elsewhere; otherwise Karen Hill and Karenni birds do not differ from *palpebrosa* and a larger series is needed before the validity of *mesoxantha* can be admitted. Mr. Riley records what seems to be the same form as *cacharensis* and had also named it *vicinia*. But if it is recognizable Salvadori's name has many years precedence. Mr. Riley states that I misled him by uniting *cacharensis* and *palpebrosa*. I had a large series of each for examination. He does not state how many he has examined from the type localities.

This is an interesting record for another reason. Recently Stresemann has suggested that *siamensis* is a race of *palpebrosa*; we now have *palpebrosa* from Karenni whence Wardlaw-Ramsay obtained *siamensis*, so that here both forms are found together.]

Zosterops erythropleura.

1 ♂.

Shot out of a large party in pine forest at 5,000 feet. The pale lemon-yellow throat and undertail coverts and the chocolate flanks of this bird are distinctive. Has the same thin day-old-chick-like cheep of *Z. palpebrosa*.

[This is an interesting record as this White-eye has been obtained only once before in Burma. De Schauensee records it from Monglin in Kengtung, Southern Shan States on 13 February. Presumably it is a winter visitor.]

Aethopyga nipalensis karenensis Ticehurst (*Ibis*. 1939, p. 755.)

4 ♂; 3 ♀.

The only Sunbird seen. It frequents both temperate forest, evergreen and open pine with rhododendron forest from 7,000 feet upwards, where it is common. Males predominate, the proportion seen being about 3 to 1.

[Birds from Myitkyina Hills and from Bhamo Hills belong to the typical form. The good series obtained on Nattaung, four males and three females, show that the type here is constant and easily separable from any other forms. There is in the male no maroon on the back and no scarlet splashing on the yellow breast and so they are widely separable from *nipalensis*. They are nearer *victoriae*; in this form the back is green with a very slight reddish tinge in it and there are splashings of red on the yellow of the underparts; in *karenensis* the back is brighter yellowish green with no red tinge and no scarlet on underparts. In addition the female is separable from both *nepalensis* and *victoriae* in having the whole crown slate-grey contrasting with the mantle instead of being concolorous with it; the underparts, too, are richer yellow.]

Arachnothera magna magna.

1 ♂.

Collected in oak forest at 6,000 feet. The only bird seen.

[It is of interest to find that the form in Karenni is *magna* as no specimens thence were available before. Birds from Arakan and Southern Chin Hills are *magna*; on the east side of the Irrawaddy in Thayetmyo, in Tharrawaddy, Pegu and Toungoo the form is *aurata*. I had already noted that birds from Karen Hills are somewhat intermediate between *aurata* and *magna*, and now we find *magna* in Karenni, as also in the Southern Shan States and N. Tenasserim. It seems that *aurata* is confined to the country between the Irrawaddy and the Sittang in Lower Burma.]

Dicaeum ignipectus ignipectus.

3 ♂.
Common in oak forest at 4,5000 feet.

Psarisomus dalhousiae dalhousiae

One bird seen in evergreen at 5,5000 feet. No specimens obtained.
[Recorded from the Karen Hills.]

Picus chlorolophus chlorolophoides.

1 ♂.
Obtained in oak forest at 6,000 feet. The only bird seen.

Dryobates atratus.

1 ♀.
Fairly common in open pine and oak forest between 5,000 and 6,000 feet.

Dryobates nanus.

1 unsexed.
Shot in pine forest at 6,000 feet.

[This single bird is unlike any others from Burma in having a very small bill. It is also very black on the upperparts, very dark on the crown, and the central tail feathers are without spots. Further material is desirable though single specimens from Karenni and the Karen Hills in the British Museum do not resemble it or differ from *canicapillus*. The form is highly variable and possibly this specimen is abnormal.

Recently Mr. Deignan has resuscitated *pumilus* from S. Tenasserim as a valid form having browner upperparts as against black upperparts in *canicapillus*. In Burma brownness and blackness is due partly to individual variation and partly to wear. Of the large series at my disposal one can see that most fresh plumaged birds are black but some are blacker than others; in worn dress most acquire a more brownish tinge and this is irrespective of locality. It so happens that the only two from near the type locality of *canicapillus* (taken in February) are the brownest of a long series of Burmese birds. The race *pumilus* seems very doubtful and the amount of material from S. Tenasserim is not sufficient to be dogmatic that the form there is different to that of Lower Burma.]

Blythipicus pyrrhotis pyrrhotis.

Seen a 5,000 feet in oak forest. It has a harsh, strident call 'churra-cha-churra-cha-churra'. No specimens obtained.

Megalaima virens virens.

Often heard in the valleys between 4,500 and 6,000 feet. It keeps to the tops of the highest trees.

[Is known from Southern Shan States, Karen Hills and the Papun District.]

Cyanops franklinii ramsayi.

1 ♀.
Common in both pine and evergreen from 4,500 feet to 7,000 feet. Not a shy bird, and allows a close approach. Often seen in low trees in the understorey. It has a loud double-note 'chu-uck, chu-uck'.

Cuculus canorus bakeri.

One bird heard calling at 6,000 feet in pine forest.

Cuculus micropterus micropterus.

Commonly heard up to about 6,000 feet.

[Recorded in Southern Shan States and N. Tenasserim.]

Hierococcyx sparvaroides.

Constantly heard up to 6,000 feet, calling most of the day, and apparently all the night.

Cacomantis merulinus querulus.

Occasionally heard at about 5,000 feet.

Chalcites maculatus maculatus.

1 ♂.
Shot in evergreen at 6,000 feet. The only bird seen.

[Is known already from the Karen Hills.]

Rhopodytes tristis longicaudatus.

Seen in re-growth at 5,000 feet.

Entomothera coromanda coromanda.

One bird seen in evergreen at 5,000 feet.

[Apparently a rare bird of which there are but few records outside Tenasserim. Recorded once at Kalaw in Southern Shan States and once in the Toungoo hills.]

Harpactes erythrocephalum erythrocephalum.

Several pairs seen in evergreen about 5,000 feet.

Hirundapus giganteus indicus.

Seen flying over the cleared top of Nattaung, 8,600 feet.

[The distribution of this Swift in Burma is little known. It has been obtained once in Karenni.]

Caprimulgus macrourus bimaculatus.

Heard at 5,000 feet.

[Said to be the commonest species of Nightjar in the Southern Shan States. Not previously recorded in Karenni.]

Glaucidium brodiei tubiger.

Heard at night at 4,500 feet and in pine forest at 6,000 feet at 8 a.m.

[Known from Karen Hills.]

Sphenocercus sphenurus sphenurus.

1 ♀.
One of a pair seen at 6,000 feet, the only ones seen.

[Is known from all the parts surrounding Karenni.]

Ducula badia griseicapilla.

Occasionally seen upto 6,000 feet.

[The type came from the higher parts of Karen Hills.]

Streptopelia orientalis agricola.

Several seen on the road at about 4,500 feet.

Gallus bankiva robinsoni.

One cock calling in a valley at 5,000 feet, the only one heard. The locality should be rich in Phasianidae, but no Pheasants were seen, nor were scratchings noticed. They have undoubtedly been exterminated, with all four-footed game, by the Karens.

Arborophila rufogularis tickelli.

2 ♀.
Both obtained at between 7,000 and 8,000 feet in evergreen with sparse ground cover. A few scratchings seen at these elevations. Also seen in temperate forest.

[Recorded from Southern Shan States, Karen Hills and N. Tenasserim.]

Francolinus pintadeanus phayrei.

The call of this bird was heard once at 5,000 feet. No specimens collected.

Turnix maculatus maculatus

1 unsexed.
Obtained in grass in open pine forest at 6,000 feet. Seen on two other occasions at the same elevation in similar type of forest.

SMALL GAME SHOOTING IN MYSORE.

BY

MAJOR E. G. PHYTHIAN-ADAMS, I.A. (*Retd.*), F.Z.S.

(*With a plate*).

The Mysore District is the southernmost of the 8 districts which comprise the State and covers some 5,500 square miles of country at an average height of 2,500 feet above sea-level. On the south and west are extensive forests, but the greater portion consists of an undulating and well cultivated plateau with occasional bare stony uplands more or less covered with scrub jungle; while on the north-east large areas are under sugar-cane. The district is well watered by two large rivers and there are many tanks, some channel fed from the irrigation canals, but mostly dependent on the rains of the north-east monsoon. The latter tends to be irregular and in consequence the amount of water in most of the tanks varies from year to year; conditions for sport being most favourable when the monsoon has to a large extent failed and the duck and teal are congregated on the few tanks which do hold a sufficiency of water.

Mysore City, the headquarters of the district, lies some 86 miles by road south of Bangalore and 100 miles north of Ootacamund in the Nilgiris; and a radius of 40 miles from the city covers all the tanks and grounds which form the basis of this article on observations made from 1925 to 1939 and from the records in the game register covering that period.

Most of the numerous State Forests are Game Preserves where no shooting is permitted, so that for all practical purposes sport with the shotgun is confined to pigeons and migratory birds.

Snipe.—As in most parts of the plains of India the snipe is the most abundant and generally distributed of all game birds in the district, and though nowhere sufficiently numerous to lend themselves to record bags there are always sufficient to add variety to the bag and at time to afford by themselves an excellent day's sport. Anything over 25 couple in a day may be considered exceptional, the best recorded being 35½ couple to two guns.

The Pintail Snipe, as usual in South India, is considerably more numerous than the Fantail. It arrives as early as September and leaves about 15th April by which time it has mostly paired, though a few birds may stay on till early May. It is of course a considerably heavier bird than the Fantail averaging over 4 ounces as against the latter's 3¼ ounces. Swinhoe's snipe were found for the first time during the past season, three being brought to bag; and they are therefore even more uncommon than in Malabar where their percentage works out at 1 to 280 Pintails as compared with 1 to 658 in Mysore.

The Fantail snipe generally arrives in October and is very locally distributed. They are on the whole wilder and their flight more erratic than Pintails, and consequently they are harder to bag than their more somnolent cousins.

Jack snipe are distinctly uncommon, but their numbers vary from year to year without any obvious reason, as in Malabar. For snipe shooting the writer has for many years used No. IX shot and finds that the closer pattern gives cleaner kills even at long range than No. 8, while experience shows that in an emergency the smaller size can be used most effectively on teal, always provided that shots are limited to birds approaching or crossing. Those who have not yet tried No. IX are strongly advised to do so.

For the table the snipe is deservedly prized; but how seldom one sees it served except roast on toast! Snipe are also excellent in a pie, or curried, while a thick snipe soup properly made with milk and a little onion is hard to beat; and an excellent potted meat can be made from them. A couple of years back one of our party had the extraordinary experience of finding a felt wad inside the snipe he was eating. One has found wads occasionally in rabbits shot at close quarters when ferretting and heard of them in pheasants and partridges, but the chances against one being found inside such a small bird as a snipe are so great that personally I should have found the incident incredible had I not been present at the table and seen our friend trying to dissect with his knife what he imagined to be an unusually tough 'trail'! The wad I may add is still in my possession.

The following table shows the different varieties of snipe shot during the past fourteen years:—

TABLE OF SNIPE SHOT.

Year	Pintail	Swinhoe	Fantail	Jack
1925–6	30	...	23	3
1926–7	38	...	21	1
1927–8	50	...	31	3
1928–9	46	...	9	1
1929–30	42	...	55	1
1930–1	190	...	49	3
1931–2	295	...	70	7
1932–3	219	...	43	2
1933–4	67	...	4	3
1934–5	129	...	80	6
1935–6	51	...	67	3
1936–7	118	...	71	6
1937–8	364	...	107	10
1938–9	334	3	156	12
Totals ...	1973	3	786	61

The Painted snipe not being a true snipe is not included in the above table, but 43 are recorded as having been bagged during the same period. Though not common, it seems to be fairly widely distributed. A nest with two eggs was found near Gundlupet on 6-8-1935, and several immature birds were shot in the same vicinity on 23-3-1938.

Geese.—The only goose found in the area is the Bar-headed, a considerably smaller bird than the Grey Lag of North India, but every bit as wary and incidentally excellent eating. Though nowhere common it is widely distributed, gaggles varying in number from half a dozen to 150 birds though the latter figure is exceptional. One favourite locality between Gundlupet and Chamrajnagar has afforded unusual opportunities for observation of a gaggle of over 100. Their custom is to assemble at dawn on a bare stony upland where an immense amount of gabbling takes place and the birds presumably secure grit. After about 15 minutes they break up into small parties which proceed in different directions to feed on the adjacent stubbles. About 9 a.m. they re-assemble in larger parties and fly in succession to the tank selected for the day's rest. Usually 1 or 2 scouts are sent ahead and then skein after skein arrives performing as they descend to the water the most amazing aerial acrobatics to the accompaniment of their usual clanging cry. By 9-30 all the parties have coalesced into one gaggle and soon all are floating peacefully asleep (except for the usual lookouts) in the centre of the tank.

Except where they can be stalked on the stubbles from behind bushes or walls, or from the bund of a small tank, they are difficult to approach and seldom allow a suspicious character to come within 150 yards. They can therefore best be brought to bag by studying their lines of flight which seldom vary and taking position accordingly. Bags are necessarily small and in the past 14 years only 28 have been collected, the best day being 8. They are tough birds and B. B. or No. 2 will be found the best size of shot. For cripple stoppers No. 7 does excellently as it gives a close pattern on head and neck; winged birds it may be added are adepts at diving and swimming under water.

Duck and Teal.—Of the *Anatidæ* found in the district only the spotbill duck and the Whistling Teal are resident. All the rest are migratory and their dates of arrival vary to some extent from year to year, doubtless being affected by the amount of water available further North, but chiefly by the date of the setting in of the North-East monsoon current. Generally speaking they do not arrive in any numbers till about the middle of November, after which fresh arrivals may be expected till the end of December. By the middle of March all the duck have gone except for an occasional straggler and the resident Spotbills, but Garganey and Cotton Teal stay for at least another month.

Bags cannot of course compare with those obtained in the more favoured parts of North India and Burma. With us a bag of 100 duck and teal in a day to 4 or 5 guns is distinctly good, and it is only in exceptional years (such as the season just ended) that this figure will be greatly surpassed, as the following list of red letter days shows:—

11 January 1926—24 duck, 15 teal and 6 snipe total 45 to 2 guns.

7 March 1935—52 duck and teal (mostly teal) in 2 hours to 1 gun.

14 March 1936—141 head including 102 teal and 21 blue rocks to 5 guns.

24 February 1939—30 duck and 75 teal (single tank) to 4 guns.

19 March 1939—187 head including 9 duck and 143 teal to 5 guns.

In 5½ days shooting during February and March 1939, 712 head were bagged by an average of 5 guns.

What sizes of shot are best? The writer finds that a No. 6 in the right barrel and an Alphamax No. 4 in the left will deal with any shots offered within reasonable range. For exceptionally high shots at duck an Alphamax No. 2 proves useful, and on account of its close pattern No. 8 is recommended for Cotton Teal.

Are duck decreasing in number? As regards Pintail, Garganey and Cotton Teal there does not appear to be any appreciable diminution in the past 14 years, but there is a definite and very noticeable decrease in the number of spotbills. Many of these birds nest in the district and suffer both from out-of-season shooting and also from their eggs being taken for food or sale by the villagers. The following table shows the numbers of duck and teal shot:—

Duck	Year	Pintail	Spotbill	Widgeon	Shoveller	Pochard	Tufted Pochard	White-eye	Brahminy	Gadwall
	1925– 6	4	32	...	4	...	...	...	...	...
	1926– 7	8	69	4	5	...	...	...	...	...
	1927– 8	5	34	1	19	...	...	...	...	1
	1928– 9	6	17	13	22	...	...	...	...	...
	1929–30	10	38	2	14	1	...	...	1	...
	1930– 1	24	31	...	4	1	2	...	...	...
	1931– 2	10	30	...	8	...	...	...	...	...
	1932– 3	3	33	...	3	...	...	...	...	...
	1933– 4	4	29	...	...	...	...	...	...	...
	1934– 5	17	34	...	13	4	1	...	...	...
	1935– 6	20	32	...	13	...	...	...	...	...
	1936– 7	12	37	2	5	2	1	...	...	...
	1937– 8	36	89	...	22	7	...	...	...	...
	1938– 9	10	60	2	44	22	3	1	...	...
	Totals ...	169	565	24	176	37	7	1	1	1

Teal	Year	Common	Garganey	Large Whistling	Lesser Whistling	Cotton
	1925- 6	3	23	...	...	10
	1926- 7	3	50	...	...	...
	1927- 8	1	39	...	3	2
	1928- 9	34	21	...	...	...
	1929-30	8	122	1	12	9
	1930- 1	4	69	...	5	34
	1931- 2	2	61	...	4	75
	1932- 3	1	43	...	7	26
	1933- 4	...	17	...	...	3
	1934- 5	27	114	...	...	64
	1935- 6	14	166	...	2	168
	1936- 7	11	87	...	19	153
	1937- 8	19	152	...	12	285
	1938- 9	20	291	...	10	531
	Totals ...	147	1,255	1	74	1,360

Note.—The bags till 1934 were mostly made by 1 or 2 guns, since then the size of the parties has increased to 4 or more guns. The figures given are therefore of interest chiefly as showing the relative proportions of the different species.

The following notes are appended on the various species:—

Pintail.—Large flocks, numbering anything up to 400 visit all the bigger tanks during the cold weather. When they first arrive in November and are still in small flocks they may often be stalked with success, but later on when they have amalgamated into larger flocks (generally of different sexes) no bird is warier, and if much disturbed, the first shot is sufficient to send them clear away to some quieter spot. As a table bird they rival the Spotbill in excellence early in the season, but their flavour appears to deteriorate later on and is then sometimes rather fishy.

Spotbill.—Though mainly resident their numbers are certainly increased by visitors during the cold weather. A few pairs may be found on most reedy tanks throughout the year and at times flocks numbering 100 and more occur on the larger tanks especially late in the season. Apparently they breed twice in the year, as flappers unable to fly were found in October 1927, small ducklings in January 1931, and flappers again in February 1931—all in different localities. Oviduct eggs were found on 15th October and 24th November.

On the whole they are not very wideawake birds and often offer easy shots, but wounded birds are expert divers and difficult to retrieve especially in lotus covered tanks. They are first class eating.

Widgeon.—An uncommon winter visitor, their numbers varying greatly from year to year; in fact several years may pass without a single one being seen.

Shoveller.—A few birds are generally to be found on most tanks in the cold weather, and at times flocks up to a dozen or more occur. I do not consider that this bird is a dirty feeder in Mysore, however bad he may be in the North, at any rate as a rule. They are generally found on clean tanks (not on village ponds) and feed on the surface of the water going round in small circles with head down and bill open to skim the surface; often found in company with a few teal.

Provided they are skinned and not plucked they are by no means bad eating.

They are not very wary birds and often give easy shots.

Pochard.—An irregular winter visitor, but by no means as rare as indicated in *Birds of South India.* The largest flock I have seen was estimated by members of our party to number from 300 to 400. This was in January 1938 on a tank near Bannur—on which occasion five were brought to bag and several lost.

Once off the water they generally afford a number of chances as they circle the tank but soon gain height (generally in dense formation) and clear right off.

As a table bird not bad eating, but not to be compared with the Spotbill or Pintail.

Tufted Pochard.—A somewhat rare winter visitor. On one occasion from a flock of 15, 2 were bagged and 3 lost—the others recorded were single birds.

Wounded birds swim fast and low in the water and are such expert divers that they are extremely difficult to retrieve. In flight when seen from below they look like large cotton teal. A poor bird for the table.

White-eye and Gadwall.—Single records.

Brahminy.—Not common. The most seen were 20 on a sandbank in the Cauvery River. If skinned the breast can be made quite palatable.

Comb duck.—None bagged, but 2 definitely recorded as seen near Gundlupet. Theobald's record of it from Kollegal no doubt refers to the Yellandur tanks in Mysore which I am informed were favourite shooting grounds of his. My recollections of it from Burma are that it was not a good bird for the table.

Common Teal.—Not common and seldom found in flocks of over 20, being more abundant some years than others. An excellent bird for the table, far better in my opinion than the garganey.

Garganey.—The commonest duck in Mysore outnumbering even the Pintails and Cotton Teal, the flocks varying from 25 to 200 or more. Fairly easily brought to bag except when wounded. A good table bird except late in the season when it is inclined to be fishy.

Large Whistling Teal.—Only recorded once when a single bird was obtained from a small flock on the Cubbany River behind the Travellers Bungalow at Nanjangud.

Lesser Whistling Teal.—A common resident generally found on weedy tanks and sometimes on rivers, and fairly distributed throughout the district. Flocks number from under a dozen to 100 or more. On the water they are not particularly wary and may often be stalked; once in the air they circle round and round the tank uttering their noisy whistling cry and keeping at a fair height, but sooner or later come within range if the gun is well concealed. Wounded birds are expert divers and difficult to recover in the reed and lotus covered tanks which they generally frequent.

I have found their nests on islands in the Cauvery in August, and saw no less than 25 pairs on a tank near Gundlupet in June. Two old birds with 7 ducklings were seen on a roadside tank near Hampapura on 21-12-1932 and I have a record of ducklings from another locality on 13-12-1936. Their breeding season therefore appears variable unless they are double brooded.

If skinned it is quite a fair table bird, and I think I am correct in stating that in Ceylon it is considered better eating than other teal.

Cotton Teal.—Common throughout the district in flocks of from 5 to 200. A few certainly stay throughout the year as I have repeatedly seen as many as 15 pairs in July, but the great majority must be migrants. It is a fairly confiding bird and difficult to rouse from the water, and then at first is inclined to bunch. But when once it is really roused it gives most sporting and difficult shots as its pace is so easily misjudged. A common habit after firing has become general is for a flock to leave the tank, circle across country and then return to the water; as they flash past in this way at breast height they give a wonderfully good imitation of driven grouse and are equally hard to hit. With such a small bird No. 8 shot will be found to give the best results—larger shot often results in a bird being winged and a winged cotton teal is generally lost, as they will stay under water for anything up to 3 minutes.

It is quite a mistake to suppose that these birds are unfit for the table—on the contrary, they are excellent eating.

Demoiselle Crane.—Flocks totalling several thousands visit the Cubbany River above and below Nanjangud annually from about 20th December when they may be heard circling Mysore city at night on arrival, and they stay till March. They feed on the paddy stubbles in the morning and evening, and pass the rest of the day and the night on sand-banks in the river. The only other places where I have seen them is on the Yellandur tanks and at the junction of the Cauvery and Cubbany Rivers at T. Narsipur.

They are not particularly difficult to bring to bag but are tough birds, and large size shot is recommended. Wounded birds are apt to be aggressive and should be approached with caution. Before they leave in March they indulge in extraordinary antics on the sand-banks. Their harsh clanging cry is responsible for their local name of Kara Kara. A first class bird for the table.

Pigeons.—Of other game birds Green Pigeons afford the most sport. They are common and widely distributed during certain months, being found in flocks of up to 50 and more feeding morning and evening on the fruit of the banian trees which line most of the main roads. Their greatest frequency occurs from October to February after which their numbers decrease and from March onwards only a few odd birds are to be seen. The large numbers seen in pairs and presumably nesting during May and June in the Mudumalai forest and at the foot of the Northern slopes of the

SMALL GAME SHOOTING IN MYSORE.

Demoiselle Cranes.

A halt for lunch.

Nilgiris doubtless come from Mysore and return there later. The South Indian green pigeon is commonest, but considerable flocks may be found of the Grey-fronted whose swifter flight and smaller size generally identifies them on the wing. Only 2 Orange-breasted green pigeons have been shot during the past 14 years both near Gundlupet, and on each occasion they were in company with the South Indian species.

They are excellent sporting birds and not difficult to bring to bag, No. 7 shot having been found the most useful size. Up to 40 a day may be expected to 2 guns. For the table they are equally good especially if skinned before cooking.

Of other pigeons the Ceylon Green Imperial occurs in small numbers and the Blue-rock is common. The latter is generally found about old bridges and temples. The Wellesley bridge at Seringapatam is a well-known locality, our best bag being 63 to 3 guns one evening as the birds came in to roost. I have met the Nilgiri wood pigeon only once in this area when 2 were shot out of 4 seen in scrub jungle some 5 miles west of Begur.

Sandgrouse.—Both Common and Painted are found in the district but they are uncommon and strictly local. Personally I know of only one locality where over 100 come to water at a small tank about 9 a.m. in the cold weather, the best bag being 22, but there are other suitable areas which no doubt hold them. I have found their nests in March and April—the average clutch being 2. Only one painted sandgrouse has so far been brought to bag out of a pair found near Nagamangala.

Great Indian Bustard.—As this is a rare bird in all parts of its habitat, a more detailed account of the 3 I have bagged may be of interest. The first occasion was in December 1929 when I was returning across country after shooting a duck tank. Our way was along the slope of a small hill covered with thorn bushes and low scrub, and as we topped a ridge I saw 2 large birds on the ground about 50 yards away, pecking about. They looked like a cross between a vulture and a peacock, and it was not till they took to flight a moment later that I realized what they were. As they had only flown some 200 yards down into a small valley full of bushes I sent my 3 men round to the right to drive them while I ran down to the left to try and intercept their probable line of flight. One came past about 50 yards away and a charge of B. B. brought it down—the other rose well out of shot and we watched its steady flight for over a mile till it disappeared behind a hill. The one shot was a magnificent bird and weighed 25 lb. Its stomach contained some crystal stones and a number of large red grasshoppers, with a brown mush presumably consisting of grass tips; it proved excellent eating. The second was one of those lucky chances which occur to every sportsman at times. It was a chance encounter in 1931 round a bush at only 30 yards, and a charge of No. 6 shot with which I happened to be loaded killed the cock dead on the spot.

On the third and last occasion a year later I visited the same spot, a rolling stony upland covered with short bushes, and after some spying with the fieldglasses spotted the long white neck of a cock watching us over a bush about 500 yards away, while further examination of the ground showed 4 more in its vicinity. A big detour and a stalk up a convenient nullah brought me within 120 yards when a solid bullet from my ·318 at the base of the neck laid low a bird whose suspicions had been aroused and which was staring at the bush behind which I was sheltering. The remainder flew off about half a mile and I spent another hour trying for another shot but without success. The only other record I have is of a cock seen flying as recently as January 1938.

These birds are already rare and unless steps are taken to give them complete protection both from sportsmen and from the professional snarers, as already suggested in the Survey of wild life in Mysore, their extinction is only a matter of time.

Other game birds which may be met with are the following:—

Florican.—I have only seen one in the past 14 years, some 30 miles north of Mysore City; so presumably it is a rare bird.

Peafowl.—Formerly common round Gundlupet and no doubt in other suitable localities, but though protected by the Game Laws it has much decreased in recent years owing to village poaching.

Grey Jungle Fowl.—Common and widely distributed in suitable localities, but suffers much from the depredations of professional snarers.

Spur Fowl.—The Red Spur Fowl is less common than the preceding, but I have shot a few round Gundlupet. Only one painted spur fowl is recorded from the same locality.

Southern Grey Partridge.—Common and widely distributed but suffers even more than the Jungle Fowl from the activities of the Pardies who snare immense numbers annually apparently without any restriction of season.

I have found only 2 nests of this bird both in July. Not a bad bird for the table though somewhat dry; but as it is a dirty feeder at times, the crops of any birds shot in the vicinity of villages should be examined before they are given to the cook.

Quail.—These are occasionally put up when snipe shooting, the Rain Quail being more common than the Grey of which I have only one record at Gundlupet. Other varieties include the Rock bush quail and the Button, but they are seldom considered worth a charge of shot.

With the exception of the hare which is seldom seen that ends the list of small game, but a few notes on shooting may be of interest.

Snipe are of course shot walking in line, but if very wild may sometimes be driven with success. In shooting a tank it is important that all guns should be in place before the rousing shot is fired and cover is most necessary. When there are tall reeds these prove ample, but often the shore is bare when a hide must be constructed out of branches or by wire netting supported on light poles with grass plaited into the mesh; the latter is a light and portable type and has proved extremely useful. A couple of decoy ducks placed in the water about 30 yards from the gun bring one a number of extra chances, Spotbills and Garganey being especially attracted. On

p. 167, Vol. XIV of the *Journal,* is an interesting note on the use of a pariah dog to decoy duck in Mysore, but I have never heard of one being used in this way. A trained shooting dog is however most useful to retrieve ducks, but care should be taken never to allow one to enter a tank in which there are known to be crocodiles or where the weed is very heavy. In the latter case a light folding boat which can be carried on the car and quickly put together, is the only method which can be used with safety, as it is unthinkable to allow a cooly to make the attempt however willing he may be.

As regards dress, a green shikar coat with khaki shorts, putties and hobnailed boots are probably best in the long run. Stockings and shoes are more comfortable but the former are little protection against water leeches which abound in some tanks, while the latter soon get filled with mud. A drawback to shorts is the water itch which is particularly bad at times, but this can be avoided by smearing the knees with carbolised vaseline before entering the water. Water itch is noticeably worse in or near a bed of bull rushes, but I have been unable to ascertain its cause, though a small waterflea has been suggested.

The subject of cartridge average is always of interest and the question is often debated as to what expenditure of cartridges constitutes a good shot. Conditions of ground, light and weather vary so from day to day that only the season's average should be considered, and I think a good all round shot taking every reasonable chance should average not less than 50% at snipe and pigeons and 33⅓% at duck and teal, counting only those birds which are actually picked up.

Too much importance should not however be placed on cartridge averages or they may spoil a man's sport. One has met men whose reputation as snipe shots, etc. was founded on the fact that they picked their birds, and never fired at one over 25 yards away, considering anything over 30 yards as hopelessly out of range. Such shooting to the average is not conducive to sport nor to a big bag, and anyone who suffers from such a complex is advised to discontinue counting his kills to cartridges.

In conclusion, any sportsman visiting Mysore between November and March should certainly bring a shotgun, as the small game shooting though nothing great, is at least very enjoyable.

ACHROIA GRISELLA FABR. AND ITS STATUS IN SOUTH INDIA.

BY

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INTRODUCTION.

The occurrence of *Achroia grisella*—the lesser wax-moth—was till recently supposed to be restricted to the western countries and information regarding its status as a pest on honey combs has been somewhat contradictory. To mention a few, Prof. Dr. A. Borchert, in his article, 'Wax-moths and their control', page 374, *American Bee Journal,* August 1938, appears to take a serious view of this pest, while F. B. Paddock in 'Bee Moths', page 422, *Journal of Economic Entomology*, vol, xxiii, 1930, states that it comes only as a scavenger after an attack of *Galleria mellonella.* In North India, C. C. Ghosh makes the first record of this pest on page 24 of *Miscellaneous Bulletin*, No. 6—Bee-keeping—of the Imperial Council of Agricultural Research, 1936 and states the following: 'There is a smaller moth known as the lesser wax-moth—*Achroia grisella* F. 'which is a smaller enemy of combs but to a much less extent than the wax-moth'.

STATUS OF THE PEST AT COIMBATORE.

At Coimbatore, the pest was for the first time noted by the authors in November 1936 causing some minor damage to stored combs. The damage caused by the caterpillars to the combs in bee colonies is practically negligible as compared with the ravages of *Galleria mellonella.* In nature the caterpillars are generally found feeding on the debris accumulated on the floor board of the artificial hive.

DESCRIPTION OF THE ADULT.

The following description is given in page 6—*Fauna of British India,* Moths, Hampson, Vol. iv.

Genus—Achroia.

Achroia, *Hubn Verg*, p. 163 (1818).

Type, *A. grisella* Fabr.

Range—Palaearctic, Oriental, and Australian regions.

Palpi minute and porrect; maxillary palpi minute; frons rounded; antennae minutely serrate; tibia roughly scaled. Fore-wing short and rounded; male with a glandular fold fringed with hair at base of costa below; vein 3 from near angle of cell; 4, 5 stalked; 6 from below the upper angle; 7, 8 stalked; 9 stalked with 7, 8 from cell or abnormally absent; 10 from cell; 11 absent—

hind wing with apex acute; vein 2 from close to angle of cell; 4 absent; 3, 5 stalked; 6, 7 stalked; 7 anastomosing with 8 to near apex.

Achroia grisella Fabr. *Ent. Syst.*, iii, pt. 2., p. 289.
A. cinereola; Hubn. Samml. eur. Schmett., Bombyces. Fig. 91.
Uniform grey brown; the head yellow.
The larva feeds on the wax in bee hives.
Hab. Europe, Calcutta, Australia, Exp. 18-20 mm.

How to Distinguish the Larvae of the two Wax-moths.

Occasionally caterpillars of *Galleria* and *Achroia* are found in close association on the combs of neglected bee colonies, but caterpillars of the bigger moth can be easily made out by their bigger size, stouter build and greyish colour. Apart from the size and colour, the two pests can be differentiated by their feeding habits which are peculiar to each. Caterpillars of the bigger moth feed voraciously on the combs after having established themselves near the central partition and constructed the tortuous silken feeding tunnels. The infestation is noticed by the presence of a whitish silken webbing over the cells and in bad cases the whole comb is eaten away leaving behind only a tangled mass of webbing which is generally white and free of any dirt or excreta. In the other case the caterpillars feed mostly on the surface hiding inside silken galleries which are completely covered by the dark pellets of excreta that adhere to it, giving it an almost brownish or even a dark colour. Besides these differences in the feeding habits, the following few variations on the external structure of the two caterpillars may also be mentioned.

Galleria mellonella	*Achroia grisella*
1. The full grown caterpillar is nearly 2.5 cm. in length, stout bodied. Pale dark in colour. Body segments thickset over the abdominal region 1-6, the two end regions tapering.	The full-grown caterpillar 1·6 cm., slender, pale whitish in colour. Body almost cylindrical and smooth over the greater portion except at the extremities which are slightly thinner.
2. Head and prothorax dark brown.	Head and prothorax light reddish.
3. A longitudinal whitish streak over the prothorax is prominent.	The streak is faint and narrow.
4. The adfrontal area between front and epicranium is dark brown and clearly demarcated.	The portion of the epicranium towards the centre, the adfrontal area and the front are of uniform light brownish tint.
5. Between the adfrontal area and the epicranial shield, there is a prominent brownish yellow thick line.	The outer boundary of the adfrontal area is very feebly indicated as a thin line.
6. The body setae are more brownish and arise from small elevated, circular blackish warts.	The body setae are softer and no conspicuous warts or tubercles present. The base of the setae are less chitinised.
7. In segment 9 (abdominal) four setae lying on the dorsal side and two on either side of the median dorsal line are seen on a plate like chitinised area,	No special chitinised plate or area on the 9th abdominal segment,

LIFE HISTORY OF THE MOTH.

The moths copulate soon after emergence and remain in copulation for about 10 or 15 minutes. Oviposition takes place on the same day. The eggs are laid in small groups but not glued with one another, generally hidden under the broken fringes of the combs or in cracks and crevices of the receptacle. The eggs are roughly spherical in shape, less than 1 mm. in size and pale white in colour. The maximum number laid by a single female was 186 and the bulk of them are laid within the first three days after copulation. Eight other moths laid 184; 153; 112; 110; 103; 94; 88; and 73 eggs respectively. The egg period lasts from 2 to 4 days. The newly hatched larva is fairly active, about 2 mm. in length, lightly pubescent with the head capsule coppery brown in colour. The tiny caterpillars burrow into the combs and feed on them constructing the characteristic silken tunnel covered with their excreta. The larval period lasts from 34 to 38 days after which the caterpillar pupates inside a silken cocoon completely covered with their excrement. The latter is generally found amidst the debris but in rare cases it is also be found on the sides of the receptacle. The pupal period lasts from 5 to 12 days after which the adults emerge. The longevity of the moths is not high, the maximum being 8 days.

THE PEST AND ITS ASSOCIATION WITH THE BRACONID— *Apanteles galleriae.*

As already mentioned, the caterpillars are generally seen gathered on the floor board of the artificial hive. The Braconid appears to parasitise these freely and numbers of their cocoons are often found in the debris, which indicate that the pest is, to a considerable extent, kept in check, by the parasite. The material collected from the floor boards of individual hives was kept separately under observation and in all the cases observed, only adults of either the lesser wax-moth or the braconid parasite emerged. This is another proof to support the statement that most of the caterpillars found on the floor board are those of *A. grisella.*

The parasite lays its eggs singly inside the caterpillar and the grubs on hatching out feed on the host and when mature, come out and construct cocoons and pupate inside them. The full grown grub is plump with the body tapering towards the head and pale yellow in colour. The total life cycle ranges from 16-22 days. The parasite is capable of reproducing parthenogetically. The average longevity of the male and female is 14 and 11 days respectively.

CONTROL MEASURES.

As the caterpillars are generally found on the floor board, frequent cleaning of the board would keep the hives free of this pest. In cases where the stored combs are attacked, drying of the attacked combs in the morning sun for about 5 minutes (temperature in the open not exceeding 95-100°F.) would drive out the caterpillars when they can be killed.

THE MEDICINAL AND POISONOUS COMPOSITES OF INDIA.

BY

J. F. Caius, s.j., f.l.s.

The Compositæ are found in all parts of the world, spread all over the warm and temperate regions, and extending even into the colder ones. They are herbs or shrubs, sometimes assuming arborescent forms in warm countries. This family far outstrips all others in the number of genera in the order, and the number of species in the genus. More than a tenth of all the species of flowering plants belong to this family, which includes about 900 genera and over 13,000 species.

Bitterness is the prevailing characteristic of the plants which compose the Order. Therapeutically these may be divided into two groups:—(1) the *Tubulifloræ* which are generally bitter, tonic, stimulant, and astringent, and in many instances diaphoretic, diuretic, and laxative; (2) the *Ligulifloræ* which are milky, bitter, astringent, and sometimes narcotic.

The following are among the substances isolated:—(1) *hydrocarbons*—cadinene, dipentene, d-limonene, phellandrene, pinene—; (2) *alcohols*—cineol, borneol, mannitol, terpineol, thuyol—; (3) *phenolic ethers*—anethol—; (4) *acetones*—camphor, thuyone—; (5) *acids*—aconitic, alantic, angelic, caproic, carthamic, gallic, lactucic, nonylic, tiglic—; (6) *esters*—pyrethrins—; (7) *sugars*—glucose, laevulose—; (8) *starches*—inulin—; (9) *resinoids*—senecin, lactucopicrin—; (10) *glucosides*—absinthin, anthemic acid, arnicin, centaurein, cyanin, eupatorin, gaultherin, inulin, lactucenin, lactucin, moschatin—; (11) *alkaloids*—abrotine, achilleine, echinopseine, β-echinopsine, echinopsine, lobelanidine, lobelanine, isolobelanine, lobelidine, lobeline, moschatine, senecifolidine, senecifoline, senecine, senecionine—; (12) *miscellaneous drugs*—absinthiin, pyrethrin, santonin—.

The medicinal and poisonous Composites of the world belong to 196 genera:—Acanthospermum (Hawaii, Singapore; Brazil); Achillea (cosmopolitan; temperate northern regions); Achyrachaena (Western North-America); Actinomeris (North America); Adenostemma (cosmopolitan); Ageratum (cosmopolitan, throughout the Tropics); Ambrosia (Mediterranean region; America); Amphidoxa (southern and tropical Africa); Anacyclus (Mediterranean region); Anaphalis (cosmopolitan; Asia, America); Antennaria (cosmopolitan, in mountains); Anthemis (cosmopolitan); Aplopappus (Chile); Arctium (temperate Asia, Europe); Arnica (Europe, Asia, North America); Artemisia (cosmopolitan; northern temperate regions, South America); Aspilia (tropical Africa; Madagascar; Mexico; South America, chiefly Brazil); Aster (cosmopolitan, northern temperate regions); Athanasia (South Africa); Athrixia

(Arabia, southern and tropical Africa, Madagascar, Australia); Atractylis (Mediterranean region; China, Japan); Baccharis (cosmopolitan; tropical America); Bellis (cosmopolitan, northern hemisphere); Berkheya (South Africa); Bidens (cosmopolitan, chiefly American); Bigelowia (northern and central America); Blepharipappus (western North-America); Blumea (tropical and subtropical Asia, Africa, Australia); Bojeria (tropical Africa, Madagascar); Boltonia (northern subtropical Asia, North America); Brachyclados (Argentina, Patagonia, Chile); Brachylaena (South Africa); Brickellia (North America, Mexico, Brazil); Calea (America, Jamaica, China); Calendula (cosmopolitan; northern Africa, southern Europe, western Asia); Callilepis (South Africa); Carbenia (Mediterranean region, Caucasus); Cardopatium (Mediterranean region, North Africa); Carduus (cosmopolitan; temperate Europe, North Africa and Asia); Carlina (Mediterranean region; Siberia, Canary Islands); Carpesium (Europe; temperate and subtropical Asia); Carthamus (Mediterranean region, Central Europe, India, Abyssinia, Canary Islands); Cenia (South Africa); Centaurea (cosmopolitan; Europe, America, western Asia, Australia); Centipeda (Asia, Australia, tropical South America); Centratherum (Asia, Australia, America); Chondrilla (Mediterranean to India; Siberia); Chrysanthemum (cosmopolitan, northern temperate regions); Chrysocoma (Caucasus, Siberia; Egypt, Arabia; South Africa, South America); Cichorium (cosmopolitan, temperate regions); Cineraria (Europe, South Africa); Clibadium (Central and South America, West Indies); Cnicus (northern temperate regions); Coleosanthus (Bolivia); Conyza (tropical and subtropical regions); Cotula (tropical and temperate regions); Crepis (cosmopolitan; northern temperate regions); Crossostephium (Central Asia, China, Luzon); Cynara (Mediterranean region, Canary Islands); Dahlia (cosmopolitan; Mexico, Central America); Dichrocephala (Asia, Africa, Madagascar); Dicoma (South Africa, India); Dimorphotheca (South Africa); Doronicum (temperate Europe and Asia); Echinacea (North America); Echinops (cosmopolitan); Eclipta (cosmopolitan, tropical); Elephantopus (cosmopolitan, chiefly tropical American); Elytropappus (South Africa); Emilia (India, tropical Africa, Madagascar); Enhydra (tropical and subtropical regions); Epaltes (tropical Asia, Africa, America); Erechtites (America, Australia, New Zealand); Erigeron (cosmopolitan; northern temperate region); Eriocephalus (South Africa); Ethulia (India, Sunda Archipelago, Java, eastern tropical Africa, Madagascar); Eupatorium (cosmopolitan, chiefly American); Euryops (South Africa); Faujasia (Mascarene Islands); Felicia (southern and tropical Africa); Filago (Europe, North Africa, Argentina, Paraguay); Flaveria (Central and South America, Australia); Gamolepis (South Africa); Garuleum (South Africa); Gazania (South Africa); Geigeria (South Africa); Gerbera (cosmopolitan; temperate regions and mountains); Glossocardia (India); Glossogyne (tropical Asia, Australia, New Zealand); Gnaphalium (cosmopolitan); Gongrothamnus (tropical Africa); Grangea (tropical Asia and Africa); Grindelia (North and South America); Guizotia (tropical

Africa); GYMNOSPERMA (Mexico); GYNURA (warm regions of Asia, Australia, and Africa); HAPLOCARPHA (South Africa); HELENIASTRUM (Chile); HELENIUM (North America); HELIANTHUS (America, mostly North America); HELICHRYSUM (cosmopolitan; temperate and subtropical regions); HEMIZONIA (California, Galapagos); HERDERIA (tropical Africa); HIERACIUM (cosmopolitan); HYPOCHOERIS (temperate regions and mountains; Europe, northern Asia, Mediterranean region, South America); HYSTERIONICA (Western America, Chile); INULA (cosmopolitan; Europe, Asia, Africa); JURINEA (Europe, Western and Central Asia); LACTUCA (cosmopolitan; northern temperate regions); LAGGERA (Asia, tropical Africa); LAMPRACHAENIUM (India); LASIOSPERMUM (South Africa); LAUNAEA (Europe, Canary Islands; South and North Africa to India; West Indies); LEONTONYX (South Africa); LEYSSERA (Mediterranean region, South Africa, North America); LIATRIS (North America); LYGODESMIA (western North America); MACROCLINIDIUM (Japan); MADIA (Chile, North America); MALACOTHRIX (North America, California, Mexico); MATRICARIA (cosmopolitan); MELANTHERA (Bahama, Yucatan); METALASIA (South Africa); MICROGLOSSA (Asia, Africa); MICROSERIS (South America, New Zealand); MIKANIA (cosmopolitan; America); MONOLOPIA (California); MONTAÑOA (cosmopolitan); NIDORELLA (southern and tropical Africa, Abyssinia, Cape Verde); NOLLETIA (Africa); NOTONIA (India, Burma, Abyssinia, tropical Africa); ONOPORDON (Mediterranean region, Europe); ONOSERIS (Mexico, South America); OSMITES (South Africa); OSMITOPSIS (South Africa); OSTEOSPERMUM (Africa); OTHONNA (cosmopolitan; South Africa); OTHONNOPSIS (Africa, Asia); PARTHENIUM (North America, Mexico); PECTIS (America, West Indies); PEGOLETTIA (Java; southern and tropical Africa); PENTZIA (South Africa); PEREZIA (Mexico, South America); PETASITES (northern temperate regions); PEUCEPHYLLUM (western North America); PICRIDIUM (Europe, Western Asia, North Africa); PICRIS (cosmopolitan; Mediterranean region, Europe, Abyssinia, temperate Asia); PIGUERIA (Mexico, Ecuador, Peru, Chile); PLEIOTAXIS (tropical Africa); PLUCHEA (tropical and subtropical regions); POLYMNIA (America); PRENANTHES (northern temperate regions); PRINTZIA (South Africa); PSIADIA (Arabia, tropical Africa, Mascarene Islands, Madagascar); PTERONIA (cosmopolitan); PULICARIA (cosmopolitan; Europe, Asia, Africa); RUDBECKIA (cosmopolitan; North America); SANTOLINA (cosmopolitan; Mediterranean region); SAUSSUREA (northern temperate regions, and mountains); SCHISTOSTEPHIUM (South Africa); SCLEROCARPUS (tropical Africa, North America, Mexico); SCOLYMUS (Mediterranean region, Nubia, Caucasus); SCORZONERA (Central and South Europe, North Africa, Asia); SENECIO (cosmopolitan; temperate climates, mountains of the tropics); SERRATULA (cosmopolitan; Europe, North Africa; western, central, and alpine Asia); SIEGESBECKIA (cosmopolitan; tropics and subtropics; Peru); SILPHIUM (North America); SILYBUM (Mediterranean region; Europe, North Africa, northern India); SOLIDAGO (North America; northern temperate regions); SONCHUS (cosmopolitan; northern temperate regions, Central Asia); SPARGANOPHORUS

Australia); Spilanthes (tropical America); Stenocline (Madagascar, Brazil); Stoebe (South Africa); Synedrella (tropical America, Africa, Asia); Tagetes (cosmopolitan; Argentina to Arizonal); Tanacetum (north temperate regions); Taraxacum (temperate and cold regions); Tarchonanthus (Africa); Tragopogon (Mediterranean region; Europe, North Africa, temperate and subtropical Asia); Tricholepis (India, Afghanistan); Trilisa (North America); Triplotaxis (tropical Africa); Tripteris (South Africa); Trixis (America); Tussilago (cosmopolitan; northern temperate regions); Ursinia (cosmopolitan; South Africa); Venidium (southern and tropical Africa); Verbesina (tropical America); Vernonia (cosmopolitan, chiefly tropical; mostly American); Volutarella (southern Europe, North Africa, western Asia, India); Wedelia (tropical and subtropical regions); Wyethia (western North America); Xanthium (cosmopolitan; Indo-Malaya, America); Xeranthemum (Mediterranean region to the East; South Africa).

The medicinal and poisonous Composites of India belong to the following 80 genera:—Acanthospermum, Achillea, Adenostemma, Ageratum, Anaphalis, Anthemis, Arctium, Artemisia, Aster, Bidens, Blumea, Boltonia, Calendula, Carduus, Carpesium, Carthamus, Centaurea, Centipeda, Centratherum, Chrysanthemum, Cichorium, Cnicus, Cotula, Crepis, Dichrocephala, Dicoma, Doronicum, Echinops, Eclipta, Elephantopus, Emilia, Enhydra, Erigeron, Ethulia, Eupatorium, Gerbera, Glossocardia, Glossogyne, Gnaphalium, Grangea, Guizotia, Gynura, Helianthus, Hieracium, Hypochoeris, Inula, Jurinea, Lactuca, Laggera, Lamprachaenium, Launaea, Matricaria, Microglossa, Mikania, Notonia, Othonnopsis, Pegolettia, Picris, Pluchea, Pulicaria, Saussurea, Senecio, Siegesbeckia, Silybum, Solidago, Sonchus, Sparganophorus, Sphaeranthus, Spilanthes, Synedrella, Tagetes, Tanacetum, Taraxacum, Tragopogon, Tricholepis, Tussilago, Vernonia, Volutarella, Wedelia, Xanthium.

A. Heads with the flowers all similar and tubular. Anthers cleft at the base. Leaves usually alternate. Flowers never yellow

I. Pappus absent.
- a. Flower-heads 1 or more, glomerate and sessile in leaf axils ... ... Sparganophorus.
- b. Flower-heads very numerous; peduncles short or long ... ... Ethulia.

II. Pappus short, fugacious.
- a. Achenes 8-10 ribbed ... ... Centratherum.
- b. Achenes terete, shining ... ... Lamprachaenium.

III. Pappus chaffy. Heads few-flowered, crowded in dense bracteate clusters ... ... Elephantopus.

IV. Pappus long, copious. Heads distinct, many-flowered ... ... Vernonia.

B. Heads with the flowers all similar and tubular. Anthers subentire at the base. Leaves opposite or alternate. Corolla rarely orange, never yellow

I. Anther-tip truncate; pappus usually of 3 clavate hairs ... ... Adenostemma.

II. Anther-tip appendiculate.
  a. Pappus usually of 5 paleaceous scales ... AGERATUM.
  b. Pappus of slender hairs; involucral bracts ∞ ... EUPATORIUM.
  c. Pappus of slender hairs; involucral bracts 4 ... MIKANIA.

C. Heads with the flowers all similar or the outer ligulate. Anthers subentire (cells not tailed) at the base. Leaves usually alternate. Receptacle almost always naked. Disk-flowers yellow; ray-flowers yellow, white or purple
I. Flowers all yellow, those of the ray ligulate
  Ligules few; heads in scorpioid panicles ... SOLIDAGO.

II. Flowers all yellow, ray absent. Pappus hardly any
  a. Receptacle conic or convex. Achenes with a terminal toothed or bristly ring ... ... GRANGEA.
  b. Receptacle usually elongate, top flat. Achenes obtuse, flat, with a thickened border ... DICHROCEPHALA.

III. Ray-flowers female, ligulate, never yellow. Disk-flowers yellow
  a. Pappus of short bristles and 2-4 long hairs ... BOLTONIA.
  b. Pappus hairs long, copious.
    1. Ligules long, uniseriate ... ... ASTER.
    2. Ligules 2-3-seriate ... ... ERIGERON.

IV. Ray-flowers very slender, tubular. Pappus-hairs copious, slender, 1-2-seriate, rather unequal ... MICROGLOSSA.

D. Heads with the flowers all similar or the outer ligulate. Leaves usually alternate. Disk- and ray-flowers usually both yellow

I. Heads androgynous. Receptacle naked. Style-arms of hermaphrodite flowers filiform, not truncate, or style of sterile flowers entire
  a. Heads corymbose or panicled.
    1. Herbs, often aromatic, with narrow bracts; pappus 1-seriate, caducous
      i. Anther-bases tailed ... ... BLUMEA.
      ii. Anther-bases not tailed ... ... LAGGERA.
    2. Shrubs or undershrubs with broad bracts; pappus 1-seriate, free or sometimes connate ... PLUCHEA.
  b. Heads in dense, globose or ovoid clusters. Herbs with decurrent leaves; bracts paleaceous, few or many. Pappus absent ... ... SPHAERANTHUS.

II. Heads androgynous or homogamous. Involucral bracts scarious, usually hyaline. Style-arms of hermaphrodite flowers truncate
  a. Hermaphrodite flowers all sterile with undivided or merely notched styles
    Heads corymbose. Pappus hairs quite free ... ANAPHALIS.
  b. Hermaphrodite flowers all or mostly fertile with divided styles
    Female flowers 2-∞-seriate. Pappus-hairs never barbellate ... ... GNAPHALIUM.

III. Heads heterogamous, radiate, rarely subdisciform or homogamous. Receptacle naked. Hermaphrodite flowers with linear style-arms, rounded or dilated at the top
  a. Heads rayed. Pappus-hairs few or many, subequal ... ... INULA.
  b. Heads rayed or discoid, heterogamous. Achenes ribbed. Outer pappus of scales, inner of hairs ... PULICARIA.
  c. Heads discoid, homogamous. Outer pappus of paleae, inner of hairs ... ... PEGOLETTIA.
  d. Heads discoid, heterogamous. Pappus absent ... CARPESIUM.

E. Heads usually radiate. Receptacle paleaceous. Anther-cells not produced into tails. Achenes 3-4-angled or terete or compressed
I. Heads heterogamous or unisexual. Hermaphrodite flowers sterile, with undivided styles; female flowers apetalous
Involucral bracts of male flowers free, of female forming a 2-flowered, 2-celled capsule armed with glochidiate spines ... ... Xanthium.

II. Heads hetero- or homogamous. Leaves usually opposite.
a. Hermaphrodite flowers sterile. Achenes spinous with 2 long horn-like spines at top ... Acanthospermum.
b. Hermaphrodite flowers fertile.
1. Inner involucral bracts embracing the achenes.
i. Outer involucral bracts 5-glandular ... Siegesbeckia.
ii. Outer involucral bracts 4, broad, in opposite pairs ... ... Enhydra.
2. Inner involucral bracts not embracing the achenes. Outer involucral bracts many ... ... Eclipta.
3. Inner involucral bracts not embracing the achenes. Paleae of receptacle concave, embracing the achenes.
i. Ray-flowers with large yellow ligules. Achenes thick ... ... Wedelia.
ii. Ray-flowers with white or yellow ligules. Achenes ciliate ... ... Spilanthes.

III. Heads very large. Pappus of 1-3 deciduous bristles or scales or both. Ligule yellow ... ... Helianthus.

IV. Heads hetero- or homogamous. Hermaphrodite flowers all fertile or neuter. Achenes dorsally compressed
a. Outer involucral bracts herbaceous, subequal. Inner shorter like the paleae of the receptacle
1. Achenes small, 4-angled, sheathed at the tip by the hairy corolla; pappus absent ... ... Guizotia.
2. Achenes flat, margins lacerate and winged; pappus of 2 slender awns ... ... Synedrella.
b. Outer involucral bracts few, small; inner membranous, connate below
1. Style-arms with short appendages. Leaves alternate ... ... Glossocardia.
2. Style-arms with short appendages. Leaves opposite. Achenes usually 2-4-awned ... ... Bidens.
3. Style-arms with long appendages. Achenes with 2 bristles ... ... Glossogyne.

F. Heads usually radiate and heterogamous. Bracts of involucre herbaceous. Receptacles without paleae. Pappus absent or of scales or bristles
Leaves opposite with oil-glands. Heads simple ... Tagetes.

G. Heads heterogamous, rayed or disciform or rayless and homogamous. Involucral bracts 2-∞-seriate. Receptacle naked or paleaceous. Style-arms truncate. Leaves usually alternate. Disk-flowers yellow, ray-flowers variously coloured

I. Receptacle paleaceous. Heads usually rayed
a. Achenes margined. Heads corymbose ... Achillea.
b. Achenes 4-5-angled or many-ribbed. Heads peduncled ... ... Anthemis.

II. Receptacle naked or with fimbriate pits

a. Heads rayed, usually long-peduncled. Achenes 5-10-ribbed ... ... CHRYSANTHEMUM.

b. Heads rayed. Achenes ventrally 3-5-ribbed, dorsally ∞-ribbed or plane ... ... MATRICARIA.

c. Heads disciform, peduncled. Involucral bracts 1-2-seriate ... ... COTULA.

d. Heads disciform, subsessile. Involucral bracts spreading in fruit ... ... CENTIPEDA.

e. Heads disciform, corymbose. Involucral bracts ∞ seriate ... ... TANACETUM.

f. Heads small, disciform, racemose or panicled ... ARTEMISIA.

H. Heads heterogamous, rayed or disciform. Involucral bracts usually 1-seriate and subequal. Style-arms of hermaphrodite flowers truncate or appendaged. Pappus of fine hairs. Leaves usually alternate. Disk-flowers yellow, rays usually also yellow

I. Involucral bracts 1-2-seriate, subequal, free nearly to the base. Style-arms of hermaphrodite flowers flattened or nearly clavate, papillose

Involucral bracts uniseriate. Heads rayed, bracteolate, solitary ... ... TUSSILAGO.

II. Involucral bracts 1-2-seriate, free nearly to the base, usually with a few smaller outer ones

a. Involucral bracts herbaceous, broad, acuminate. Heads large, rayed, long-peduncled

Receptacle hemispheric. Herbs, leaves alternate. DORONICUM.

b. Involucral bracts narrow with a few much shorter outer ones, except *Emilia* and some *Senecio*

1. Heads homogamous. Style-tips long, hairy ... GYNURA.

2. Heads homogamous, ebracteolate ... ... EMILIA.

3. Heads homogamous, style-tips ovate. Fleshy shrubs ... ... NOTONIA.

4. Heads rayed or disciform, homogamous. Style-tips truncate or short or absent. Leaves radical or alternate ... ... SENECIO.

5. Heads heterogamous. Hermaphrodite flowers sterile. Glabrous undershrubs ... ... OTHONNOPSIS.

I. Heads rayed. Involucral bracts 1-2-seriate, narrow, subequal. Style-arms of hermaphrodite flowers truncate or in sterile flowers undivided. Achenes without pappus

Achenes incurved. Herbs, with alternate leaves ... CALENDULA.

J. Flowers all tubular. Involucral bracts many-seriate, imbricate. Tips scarious, spinous or foliaceous. Achenes often hard. Pappus various, rarely absent. Leaves alternate, often spinous

I. Heads 1-flowered, crowded into involucrate globose balls ... ... ECHINOPS.

II. Heads ∞-flowered, separate. Achenes glabrous. Pappus-hairs distinct or connate

a. Filaments free glabrous. Pappus hairs free, caducous. Involucral bracts with hooked bristles. Leaves unarmed ... ... ARCTIUM.

b. Filaments papillose-hairy. Pappus-hairs connate into a deciduous ring

1. Pappus-hairs simple, not feathery ... ... CARDUUS.

2. Pappus-hairs feathery ... ... CNICUS.

c. Filaments glabrous, connate

Involucral bracts spinous. Receptacle bristly. Pappus simple ... ... SILYBUM.

d. Filaments free, glabrous

1. Pappus-hairs uniseriate, feathery, with a few outer simple ... ... SAUSSUREA.

2. Pappus-hairs ∞-seriate, rigid, rough or feathery. JURINEA.

III. Heads separate, ∞-flowered. Achenes glabrous. Basal areole oblique or lateral
  a. Involucre not bracteate at the base or rarely so
    1. Filaments papillose. Anther-tails lacerate. Achenes smooth ... ... Tricholepis.
    2. Achenes terete, 10-15-ribbed ... Volutarella.
    3. Achenes compressed or 4-angled, 4-5-ribbed ... Centaurea.
  b. Involucre bracteate at the base by spinous leaves Achenes compressed or angled. Pappus paleacous or absent ... ... Carthamus.

K. Heads hetero- or homogamous, rayed or not. Involucral bracts ∞-seriate, unarmed. Corolla 2-lipped, ligulate, or deeply 5-fid. Style-arms rounded or truncate, not appendaged. Leaves rarely opposite.
  a. Corolla tubular. Pappus hairs feathery. Rigid shrubs ... ... Dicoma.
  b. Corolla 2-lipped or ligulate. Scapigerous herbs Gerbera.

L. Heads homogamous. Corollas all ligulate. Ligule truncate, tip 5-toothed. Style-arms slender, Herbs; juice usually milky. Leaves radical or alternate, never opposite
  I. Achenes truncate. Pappus of scales with sometimes alternating hairs or absent
    Rigid herbs. Flowers blue. Inner involucral bracts coriaceous, concave ... ... Cichorium.
  II. Achenes usually contracted at both ends. Involucre calyculate, inner bracts often thickened. Usually leafy herbs, not woolly nor with stellate hairs.
    a. Achenes ribbed, rugose; pappus hairs feathery ... Picris.
    b. Achenes ribbed; pappus hairs simple, free, white. Crepis.
  III. Herbs, usually perennial, more or less stellately hairy. Achenes truncate. Pappus hairs simple.
    Pappus hairs rigid, bristles usually rough, brown. Hieracium.
  IV. Scapigerous herbs. Hairs various. Achenes contracted below. Pappus-hairs simple or feathery
    a. Receptacle naked. Pappus-hairs simple ... Taraxacum.
    b. Receptacle paleaceous. Pappus hairs feathery ... Hypochoeris.
  V. Herbs, rarely shrubby below, glabrous or hispid, rarely scapigerous. Achenes usually narrowed below. Pappus-hairs many, simple
    a. Achenes compressed, beaked, ribs smooth ... Lactuca.
    b. Achenes compressed, not beaked, many-ribbed. Ribs smooth or rough ... ... Sonchus.
    c. Achenes narrow, truncate at both ends, 4-5-ribbed. Launaea.
  VI. Herbs, glabrous, woolly or hispid. Achenes with a broad base, or curved hollow stipes, above narrowed or beaked ... ...
    Involucral bracts 1-seriate. Achenes long-beaked. Tragopogon.

ACANTHOSPERMUM.

This genus numbers three species known from tropical America and Hawaii.

In Gold Coast *A. hispidum* DC. is used in the treatment of leprosy.

One of the species, **A. Brasilium** Schrank, is now established in and about the town of Singapore. An infusion of the leaves—4 parts in 200 parts of boiling water—is used in Brazil as a diuretic and sudorific. The aromatic bitter leaves are also recommended in the treatment of blennorrhagia.

Brazil: Picao da praia—; *Uruguay*: Yerba de la oveja—.

ACHILLEA.

The genus includes 115 species, natives of temperate regions of the northern hemisphere.

The following species are used medicinally in Europe—*A. Ageratum* Linn., *A. atrata* Linn., *A. Millefolium* Linn., *A. moschata* Jacq., *A. nana* Linn., *A. nobilis* Linn., *A. Ptarmica* Linn.—; in China and Indo-China—*A. sibirica* Ledeb.—; in North America—*A. Millefolium* Linn.—; in India—*A. Millefolium* Linn., *A. Santolina* Linn.—.

1. Rays white, pink or purple ... ... *A. Millefolium.*
2. Rays yellow ... ... *A. Santolina.*

1. Achillea Millefolium Linn. is found in the western Himalaya, from Kashmir to Kumaon, at altitudes of 6,000 to 9,000 feet. It extends to Northern Asia, Europe, and North America. A very common plant on roadsides and pastures and banks.

Many healing virtues have been and are still ascribed to this herb which, whatever its virtues may be, is still regularly cultivated for medicinal purposes. The annual consumption in the British Isles alone is from 10 to 20 tons. The herb is officinal in Austria; and the leaves are officially recognized in Portugal, Russia, Sweden, and Switzerland.

The herb is diaphoretic, stimulant, tonic. It is most useful in colds, obstructed perspiration, and the commencement of fevers. It opens the pores freely and purifies the blood. It has also proved useful in hysteria, flatulence, heartburn, colic, and epilepsy.

It is much used in England as a vulnerary, and is given internally for the suppression of haemorrhages and of profuse mucous discharges. It is employed also in intermittents and as an antispasmodic in flatulent colic and nervous affections. Its hot infusion is used as an emmenagogue in France, and also in the suppression of the lochia; it is sometimes employed in low exanthematous fevers with difficult eruption. In the United States the infusion is occasionally used in acute suppression of the menses.

An ointment made by the Highlanders of Scotland of the fresh plant is good for piles, and is also considered good against the scab in sheep. Milfoil tea is held in much repute in the Orkneys for dispelling melancholy. A decoction of the whole herb is employed for bleeding piles, and is good for kidney disorders. It has the reputation also of being a preventive of baldness, if the head be washed with it.

A medicinal tincture is prepared from the whole plant with spirit of wine. This, when employed in a diluted form of the first or third decimal strength, and in small doses from five to ten drops in a tablespoonful of cold water, will act admirably in arresting bleeding from the lungs, the kidneys, or the nose, especially in florid hectic subjects. It has been found by healthy provers that stronger or larger doses of any preparation of the herb will induce or aggravate one or another of these bleedings.

To stimulate and promote the appetite the fresh juice of the plant may be had, a dessertspoonful three times in the day.

Italian peasants apply the fresh juice topically as an astringent to piles, varicose ulcers, and sore nipples. Among the Spanish-Californians the fresh plants are used for stanching the blood in recent wounds.

Linnaeus recommended the bruised herb, fresh, as an excellent vulnerary and styptic. It is employed in Norway for the cure of rheumatism, and the fresh leaves chewed are said to cure toothache.

In France the powdered dried leaves are used as a sternutatory. Or the leaf, being rolled up, is applied to the nostrils to cause bleeding and thus afford relief to headache.

In Scotland a warm decoction of the fresh leaves is regarded as a family specific against the colds and other ailments common to childhood.

Externally, a strong decoction of the leaves has been used as an injection into the nostrils to stay bleeding from the nose. It is similarly of service for piles, and for female floodings, because exerting a special local action on the organs within the middle trunk. It is further of benefit for sore nipples as a lotion, and for a relaxed sore throat as a gargle; also as a hair-wash.

An infusion was used by the Winnebag Indians of North America to bathe swellings. For earache a wad of the leaves, also the infusion was put into the ear.

In California the leaves steeped in hot water are considered very healing applications to cuts or bruises, and are used for poulticing skin rash.

The flowering plant or flowers are stimulant, aromatic, sudorific, tonic, astringent, diuretic, and vulnerary. An essential oil, extracted from the flowers, is taken in a dose of from three to five drops to stimulate and promote the appetite.

Mahommedan writers acknowledge the virtues of the plant collected in the wild state, when in flower.

In Sweden and in some parts of Africa the plant has been used in the manufacture of beer. Linnaeus considered beer thus brewed more intoxicating than when hops were used.

Achilleine, an amorphous bitter alkaloid of unknown composition, has been isolated.

Afghanistan: Buimaderan—; *Arabic*: Suila—; ***Bombay***: Rojmari—; *California*: Milfoil, Old Man, Yarrow—; *Catalan*: Herba de tall, Marfull, Milfulles, Percala—; *Colombia*: Colchón de pobre—; *Cutch*: Biranjasif—; *Danish*: Roellike—; *Dutch*: Duizenblaad, Duizendblad—; *English*: Bad Man's Plaything, Bloodwort, Carpenter's Weed, Devil's Nettle, Devil's Plaything, Knight's Milfoil, Milfoil, Nosebleed, Old Man's Mustard, Old Man's Pepper, Sanguinary, Soldier's Woundwort, Staunch Grass, Staunchweed, Thousand Leaf, Thousand Weed, Yarrow, Yarroway—; ***French***: Achilléine, Endove, Herbe à la coupure, Herbe au charpentier, Herbe aux charpentiers, Herbe aux cochers, Herbe aux coupures, Herbe aux militaires, Herbe aux voituriers, Herbe à saigner, Herbe de Saint Jean, Herbe militaire, Millefeuille, Saigńe nez, Seignenez, Sourcils de Vénus—; *German*: Achilleskraut, Angerblume, Anserine, Bauchwehkraut, Edelgarbe, Fasankraut, Feldgarbe, Gachel, Gacht, Gaensezungen, Gaerb, Garwekraut, Gerbel, Gollenkraut, Gor, Gotteshand, Grillen, Grinsing, Gruensing, Gruettblume, Gruetzenkraut, Grundheil, Hasegerf, Hasengarbem, Heftkraut, Heidekraut, Jase, Judenkraut, Jungfraukraut, Kachelblume, Karweblume, Katzenfittich, Katzenschwanz, Kelkenkraut, Kerpen, Kraenzel, Krebselkraut, Loewenfusskraut, Margaretenkraut, Marienkranz, Reels, Reelse, Relaka, Releke, Relik, Relkike, Roehlke, Roelken, Roellicke, Roelskraut, Rohlech, Ruels, Saegkraut, Schabab, Schabor, Schafgarbe, Schaffripchen, Schafrippe, Schafzunge, Schapschar, Schober, Sichelblume, Sichelschnitt, Siebengartenkraut, Tausendblatt, Weisses Garbenkraut, Zeiskraut, Zimmermannskraut—; *Greek*: Myriophyllon—; *Hindi*: Gandana—; *Hungarian*: Ezer-levelu-fa—; *Irish*: Athairthalmhna—; *Italian*: Millefoglie, Millefoglio—; *Kashmir*: Momadruchopandiga—; *Malta*: Common Milfoil, Yarrow, Haxixa tal morliti—, *Pacific Coast*: Dog-daisy, Green Arrow, Milfoil, Nose-bleed, Oldman's Pepper, Soldier's Woundwort, Yarrow—; *Persian*: Buimaderan—; *Polish*: Tysiacznik ziele—; *Portuguese*: Mil em rama, Milfolha, Milfolhada—; *Roumanian*: Coada soarecelului—; *Russian*: Tesyachelistnik—; *Saxon*: Gearwe—; *Spanish*: Filigrana, Manzanilla de los montes, Milefolio, Milenrama, Milhojas, Yerba de Aguiles, Yerba de San Juan—; *Swedish*: Roelleke, Roflleka—; *Urdu*: Biranjasifa—.

2. **Achillea Santolina** Linn. is found in Baluchistan, whence it extends to Afghanistan, Iran and the Mediterranean. It is widely distributed in the East and in Northern Africa.

The plant is in common use as a tonic and carminative in Iran and Sind. At Chaman, in Baluchistan, it is given to children to cure stomachache. The strong odour of the herb drives away fleas and other noxious insects.

Arabic: Rebey-el-ghebel—; *Egypt*: Ba'eytheran, Bishrin, Ghobeyra, Gesum—; *Iraq*: Gaisum, Qaisum—; *Kalat*: Bo-i-madaran—; *Mach*: Boemadran—; *Persian*: Biranjasib, Biranjasif, Bu-i-maderan—; *Pushtu*: Zawal—; *Teheran*: Bumadran—.

Adenostemma.

The genus consists of 5 or 6 American species, one of them cosmopolitan.

Adenostemma viscosum Forst. is found in all tropical countries. It occurs throughout India, Ceylon, and the Malay Peninsula. It is common in waste ground and in damp spots in forests, ascending to 4,000 feet in Malaya, to 5,000 feet on the Himalaya and other ranges, and to 6,000 feet in Ceylon.

The plant is used medicinally in La Reunion, the leaves are antispasmodic, and the fresh juice is a good stimulant and sternutatory.

Malay: Rumput babi, Rumput pasir, Sumbong gajah—.

Ageratum.

The genus numbers 45 American species, one of them cosmopolitan.

Ageratum conyzoides Linn. is one of the commonest weeds of the Tropics. It is found throughout India, common everywhere in waste ground and on the outskirts of villages; it ascends the Himalayas to 5,000 feet.

The plant is applied externally in ague. Its juice is said to be a good remedy for prolapse of the anus. It is used in Togoland to cure fever. In Yoruba a decoction is given for 'craw-craw' externally and for fever internally. An infusion is prescribed in

Brazil and Guiana as a stimulant tonic in diarrhoea and flatulent colic.

The juice of the root is said to possess antidysenteric properties and, together with the leaves, is a common Indo-Chinese remedy for diarrhoea and dysentery. The juice of the root is moreover credited with the virtue of preventing the formation of stone or calculus in the bladder.

In Ceylon the leaves are commonly applied to wounds and sores; they act as a styptic and heal them quickly. In Gold Coast Colony the leaves are squeezed, and the juice is used as a lotion for the eyes. In Sierra Leone the chief use of the leaves is a remedy for craw-craw; they are also applied to chronic ulcers, and intravaginally for uterine troubles; crushed in water they are given as an emetic. In Southern Nigeria a decoction is both used as a lotion for craw-craw and taken internally for fever. In Siberia pneumonia in children is treated by rubbing an extract of the leaves on the chest. In South Cameroons the leaves pounded with *Ocimum* and macerated in water along with 'bush pepper' are prepared as a purgative enema. Some tribes in Portuguese Congo use it in the treatment of sleeping sickness.

The plant is a household medicine in Madagascar, Mauritius and La Reunion. As a fomentation the leaves and stems are used in skin diseases, more particularly leprosy; and they are prescribed as a bath to patients with ecchymoses. A poultice of the leaves is applied on boils; it is said to prevent tetanus if applied to a wound. A cold decoction of the roots is used as a lotion in purulent ophthalmia.

Ashanti: Gu-ekura, Guakuro—; *Australia*: Billy-goat weed—; *Bengal*: Dochunty, Uchunti—: *Benin*: Ebighoedore, Ehigodore—; *Betsimisaraka*: Fotsivony, Tinimbo—; *Bombay*: Osari, Sahadevi—; *Brazil*: Camara apeba, Fumo bravo, Mentrasto, Suacuaira—; *Ceylon*: Pumpillu—; *Efik*: Ikongifoiyen, Otitidahadaha—; *English*: Goatweed, White Weed—; *Ewe*: Mimang—; *Fanti*: Efungmormoe—; *French*: Herbe à Madame—; *French Guiana*: Raguet françois—; *Gold Coast*: Goat Weed—; *Gujerati*: Ajgandha, Gandharisedardi, Mankdamari—; *Ibo*: Ikbu odols—; *Ibuzo*: Ikbu odolo—; *Indo-China*: Bong thui, Bu xich, Cut lon, Thang hong ke—; *Karwar*: Ghayamari—; *Kathiawar*: Makadamari—; *Konkani*: Sahadevi—; *Lagos*: Imi-esu—; *La Reunion*: Herbe à bouc—; *Lepcha*: Nam-yu muk—; *Madagascar*: Hanitrinimpantsaka—; *Mano*: Dah vo—; *Malay*: Sianggit, Tahi ayam, Tombok jantan—; *Malayalam*: Appa, Muryanpacha—; *Marathi*: Ghanera osadi—; *Mauritius*: Herbe de bouc—; *Mende*: Ngugbe, Ngulugbei, Yanigbei—; *Mundari*: Purudumbu—; *Nepal*: Ilami—; *New Caledonia*: Adivijalakara—; *Oloke-Meji*: Imi-esu—; *Owerri*: Ahihia-nwa-oshi-naka, Akwukwo-moosinaka, Osu angweri ngwa—; *Sierra Leone*: Akan yunyun, Craw-craw plant—; *Sinhalese*: Hulantala—; *Timne*: Balkeyan, Ka-balkeyan, Keyan—; *Twi*: Guakuro, Gu airkuna, Gu-ekura—; *Umu Ahia*: Osu angrocri ngwa—; *Uriya*: Boksunga, Poksunga—; *Wassaw*: Ahaban kankan—; *Yoruba*: Akkaw-yungun, Imi-eshu—.

Anaphalis.

The genus consists of 50 species, chiefly temperate and mountain plants of Asia, Europe, and America.

A. margaritacea Benth. and Hook. is used medicinally in North America.

In the Nilghiris several species are used for cut wounds. The more commonly employed is **A. neelgerryana** DC., which occurs at an altitude of 7,000-8,250 feet. The fresh leaves are bruised and applied to the wound as a plaster.

Nilghiris : Katplaster—; *Sanskrit* : Raktaskandana, Vranapata—.

ANTHEMIS.

The genus includes 120 species, natives of Europe as far as Siberia—only one being native of Abyssinia—, and often naturalised elsewhere.

A. arvensis Linn., *A. Cotula* Linn., and *A. nobilis* Linn. are used medicinally in Europe and in North America; *A. Gayana* Boiss. and *A. odontostephana* Boiss. in Baluchistan; *A. Wiedemanniana* Fisch. and Mey. in Persia.

1. Achenes turbinate, tubercled, tip crenulate ... *A. Cotula.*
2. Achenes smooth, sulcate, slightly narrowed at the base, angular, truncate at the apex; margin acute, narrow ... ... *A. Gayana.*
3. Achenes cylindric, ribbed, tubercled; tip of outer toothed, of inner with a short auricle ... ... *A. odontostephana.*

1. **Anthemis Cotula** Linn. occurs in Baluchistan and Northern Asia. It is distributed westwards to Britain and the Canary Islands; and is found in Europe, North Africa, Siberia and West Asia. It has been introduced into North America.

The flowers and the leaves are tonic, antispasmodic, emmenagogue, and emetic. They have been used with success in sick headache, in convalescence from fevers, and in the absence or abnormal stoppage of the menses. The warm infusion of 1 ounce in 1 pint of boiling water is taken in wineglassful doses when required.

A strong decoction causes sweating and vomiting. It is said to be nearly as valuable as opium in dysentery. It has also been used in scrofula, dysmenorrhoea and flatulent gastritis. It is administered to induce sleep in asthma.

Applied to the skin fresh and bruised it is a safe vesicant. A poultice helpful in piles can be made from the herb boiled until soft, or it can be used as a bath or fomentation.

In hysteria the herb is used in Europe as an antispasmodic and emmenagogue. It is prescribed in North America for pulmonary and rheumatic affections.

The whole plant has a very foetid odour, which rubbing increases. It is full of an acrid juice which is liable to blister. Bees dislike it, and it is said to drive away flies and fleas.

Catalan : Camamilla pudenta—; *England* : Balder Brae, Baldeyebrow, Camomile, Camovyne, Cotula, Dog's Camomile, Dog-binder, Dog Daisy, Dog-fennel, Dog-finkle, Flowan, Hog's Fennel, Horse Daisy, Jayweed, Madder, Madenwede, Marse, Marg, Mathes, Mayweed, Morgan, Murg, Poison Daisy, Stinking Camomile, Wild Camomile—; *French* : Amarelle, Amouroche, Bouillot, Camomille fétide, Camomille puante, Chaillerie, Chamaran, Chamarou, Herboula, Maroule, Maroune, Maroute, Maroute puante, Oeil-de-vache, Queuneron—; *German* : Hundskamille, Hundskamillenkraut, Stinkende Kamille—; *Italian* : Camomilla puzzolente—; *Pacific Coast* : Bald-eyebrow, Chigger-weed, Dill-weed, Camomile, Dog Daisy, Dog-fennel, Fetid Mayweed, Fieldwort, Hog-fennel, Horse Daisy, Madder, Mayweed, Poison Daisy, Stinking Camomile—; *Roumanian*: Mararui-cainalui, Mormorita, Romanita-puturoasa—; *Spanish*: Cotula fetida, Manzanilla hedionda—; *Uruguay*: Manzanilla—.

2. **Anthemis Gayana** Boiss. inhabits Baluchistan whence it extends to Persia.

In the Harboi Hills the leaves are eaten to cure pains in the chest.

Harboi Hills: Piunphuli—.

3. **Anthemis odontostephana** Boiss. is found at Peshawar, whence it spreads to Afghanistan, Baluchistan, and Persia.

A decoction of the flowers is used in Baluchistan as a febrifuge and carminative.

ARCTIUM.

The genus consists of 3 or 4 species spread over temperate Asia and Europe.

Arctium Lappa Linn. is found in Western Himalaya from Kashmir to Simla at altitudes of 6,000-8,000 ft., and also in Western Tibet where it ascends to 11,000-13,000 feet. It extends westwards towards the Atlantic and occurs in Syria, Persia, and Khorasan, as well as in Europe. It is common in North and Central China, and Manchuria, and is abundant in the United States.

The root is regarded throughout India as depurative and antiphlogistic. In Teheran the root, with that of sarsaparilla, is used as a remedy for syphilis. In the Pacific Coast States of America the dried first year root is considered alterative, aperient, diuretic, and diaphoretic.

The root, stem, and seeds are used medicinally in China. The seeds are alterative, depurative, diaphoretic, and diuretic.

The plant grows freely throughout Europe and the United States on waste ground and about old buildings, by roadsides and in fairly damp places. It had a great reputation in the past, and its fruits and roots still figure largely among the drugs commonly used by herbalists in Europe and America. It is alterative, diuretic, and diaphoretic; one of the finest blood purifiers in the herbal system. In all skin diseases it is a certain remedy and has effected a cure in many cases of eczema. The root is principally employed, but the leaves and fruits—erroneously called seeds—are equally valuable. Both root and seed may be taken as decoction of 1 ounce to a pint and a half of water, boiled down to 1 pint, in doses of a wineglassful three or four times a day. The antiscorbutic properties of the mucilaginous, demulcent root make the decoction very useful for boils, scurvy, and rheumatic affections; it has in addition been recommended for external use as a wash for ulcers and scaly skin disorders. It is officinal in Portugal and Spain.

An infusion of the leaves is useful to impart strength and tone to the stomach, for some forms of long-standing indigestion. When applied externally as a poultice, the leaves are highly resolvent for tumours and gouty swellings, and relieve bruises and inflamed surfaces generally. The bruised leaves have been applied by the peasantry in many countries as cataplasms to the feet and as a remedy for hysterical disorders.

From the seeds (or fruits), both a medicinal tincture and a fluid extract are prepared, of benefit in chronic skin diseases when taken, in doses of from ten to thirty drops with two tablespoonfuls of cold water three times a day, steadily for several weeks or months. Americans consider the seeds more efficacious and prompt in their action than the other parts of the plant. They are relaxant and demulcent, with a limited amount of tonic property. Their influence upon the skin is due largely to their being of such an oily nature; they affect both the sebaceous and sudoriferous glands and restore to the skin that smoothness which is a sign of normal healthy action.

The infusion or decoction of the seeds is employed in dropsical complaints, more especially in cases where there is co-existing derangement of the nervous system, and is considered by many to be a specific for all affections of the kidneys, for which it may with advantage be taken several times a day, before meals.

The root contains inulin, mucilage, sugar, a bitter crystalline glucoside called lappin, a little resin, and tannic acid. The ashes of the plant, burnt when green, yield carbonate of potash abundantly, and also some nitre.

Anglo-Saxon: Fox's clote—; *Catalan*: Bardana, Llapassa, Repalassa—; *China*: E Shih, Niu P'ang, Niu Tzu, Ta Li, Wu Shih—; *Dutch*: Dokkebladen, Klis, Klisse, Klit—; *English*: Aireve, Airup, Beggar's Buttons, Burdock, Clithe, Clot-bur, Cockle-buttons, Cuckle-buttons, Cuckoo Button, Great Burdock, Happy Major, Hardock, Harebur, Herrif, Hurbur, Lappa, Love Leaves, Personata, Philanthropium, Turkey-bur, Thorny Bur—; *French*: Bardane, Bardane à grosses têtes, Bouillon noir, Coupeau, Dogue, Glouteron, Glotteron, Grande bardane, Gratteau, Grippe, Guippon, Herbe aux bardanes, Herbe aux teigneux, Lappe, Oreille de géant, Peignerolle, Picons, Poire de vallée—; *German*: Gemeine Klette, Grosse Klette, Klette—; *Greek*: Arkeion, Arktion, Prosopion, Prosopis—; *Italian*: Arsio, Bardana, Lappa maggiore, Lappola maggiore—; *Malaya*: Ngow chee—; *Pacific Coast*: Bazzies, Beggar's Buttons, Burdock, Cuckoo-button, Great Burdock, Harebur, Turkey-bur—; *Polish*: Lopian—; *Portuguese*: Bardana—; *Roumanian*: Brustur, Lipan—; *Russian*: Lapushnik, Rapeynik—; *Spanish*: Amores ruines, Bardana, Lampazo, Lapa—; *Teheran*: Bardane—.

Artemisia.

This genus includes about 280 species, natives mostly of the northern hemisphere, a few from South Africa and South America.

The following species are used medicinally in Europe.—*A. Absinthium* Linn., *A. abrotanum* Linn., *A. arborescens* Linn., *A. caerulescens* Linn., *A. campestris* Linn., *A. Dracunculus* Linn., *A. gallica* Willd., *A. glacialis* Linn., *A. Herba-alba* Asso, *A. hispanica* Lam., *A. maritima* Linn., *A. Mutellina* Willd., *A. pontica* Linn., *A. scoparia* Waldst. and Kit., *A. spicata* Wulf., *A. vallesiana* Lam., *A. vulgaris* Linn.—; in Palestine and Syria—*A. Herba-alba* Asso, *A. judaica* Linn.—; in Arabia and Egypt—*A. judaica* Linn.—; in Persian and Turkistan—*A. Cina* Berg., *A. Vahliana*

Kostel—; in China *A. annua* Linn., *A. apiacea* Hance, *A. capillaris* Thunb., *A. japonica* Thunb., *A. Heiskeana* Miq., *A. stelleriana* Bess., *A. vulgaris* Linn.—; in Indo-China—*A. abrotanum* Linn., *A. annua* Linn., *A. apiacea* Hance, *A. capillaris* Thunb., *A. carvifolia* Roxb., *A. sina* Berg., *A. japonica* Thunb., *A. Heiskeana* Miq., *A. maritima* Linn., *A. vulgaris* Linn.—; in Malaya—*A. maritima* Linn., *A. vulgaris* Linn.—; in the Philippine Islands—*A. vulgaris* Linn.—; in North America—*A. Absinthium* Linn., *A. ludoviciana* Nutt., *A. Santonicum* Linn.—; in the Pacific Coast States—*A. Absinthium* Linn., *A. annua* Linn., *A. californica* Less., *A. dracunculoides* Pursh., *A. tridentata* Nutt., *A. vulgaris* Linn.—; in Mexico—*A. mexicana* Willd.—; in North Africa and the Canary Islands—*A. ramosa* C. Sm.—; in South Africa—*A. afra* Jacq.—.

A. Heads heterogamous, outer flowers female, disk-flowers hermaphrodite, sterile. Receptacle naked
  1. Perennial ... ... 4. *A. Dracunculus.*
  2. Annual. Very strong scented ... ... 2. *A. annua.*
  3. Annual, or rootstock perennial. Faintly scented ... 8. *A. scoparia.*

B. Heads homogamous. Flowers all fertile. Receptacle naked ... ... 5. *A. maritima*

C. Heads heterogamous. Ray-flowers female, disk-flowers hermaphrodite, all fertile.
  1. Receptacle puberulous. Perennial with rather large head ... ... 6. *A. persica.*
  2. Receptacle naked.
    a. Annual; quite glabrous ... ... 3. *A. caruifolia.*
    b. Perennials with usually small heads.
      i. Leaves large, ovate, lobed, laciniate or 1-2 pinnatipartite ... ...10. *A. vulgaris.*
      ii. Leaves long-petioled, ovate- pinnatisect ... 7. *A. sacrorum.*

D. Heads heterogamous. Ray-flowers female, disk-flowers hermaphrodite, both fertile. Receptacle covered with long hairs
  1. Perennial ... ... 1. *A. Absinthium.*
  2. Annual or biennial ... ... 9. *A. Siversiana.*

1. **Artemisia Absinthium** Linn. inhabits Kashmir where it is found at altitudes of 5,000—7,000 ft. It is distributed over Northern Asia, Afghanistan, and westwards to the Atlantic. It is now naturalized and rather common in eastern Canada to Pennsylvania, growing along roadsides and waste places.

The herb has a strong fragrant odour which exercises a powerful influence over the nervous system. Its tendency to produce headache and other nervous disorders is well known by travellers in Kashmir and Ladak, who suffer severely when marching through the extensive tracts of country covered with this plant.

The whole plant is an aromatic tonic, and formerly enjoyed a high reputation in debility of the digestive organs. Wormwood tea, or the powdered herb in small doses, mixed in a little soup, will serve to relieve bilious melancholia, and will help to disperse the yellow hue of jaundice from the skin.

The juice of the larger leaves which grow from the root before the stalk appears has been used as a remedy for jaundice and dropsy, but it is intensely nauseous. A light infusion of the tops of the plant, used fresh, is excellent for all disorders of the stomach, creating an appetite, promoting digestion, and preventing sickness after meals, but it is said to produce the contrary effect if made too strong.

The flowers, dried and powdered, are said to be most effectual as a vermifuge, and used to be considered excellent in agues. Before the discovery of cinchona they were largely used in intermittents.

The plant yields by distillation a dark green or yellow oil which is used as worm-expeller. However, Caius and Mhaskar have shown experimentally that neither the herb nor the oil are effective as anthelmintics against hookworms. In large doses the volatile oil is an active narcotic poison. The main constituents of the oil are absinthol and absinthin, the former largely responsible for the characteristic odour of the plant and the latter for its intense bitter taste.

The herb is prescribed in the form of a poultice or fomentation as an antiseptic and discutient.

Arabic : Afsantin—; *Bologna* : Zicus—; *Catalan* : Donsell, Donzell, Donzell mascle—; *Como* : Medegh—; *Danish* : Malurt—; *Deccan* : Vilayatiafsantin—; *Dutch* : Alsem, Groote Alsem—; *English* : Absinth, Green Ginger, Madderwort, Mingwort, Mugwort, Warmot, Wermuth, Wormwood—; *French* : Absin menu, Absinthe, Absinthe amère, Absinthe commune, Absinthe vulgaire, Alliene, Aloïne, Alunine, Aluyne, Alvine, Alvuine, Aoussin, Armoise-absinthe, Armoise amère, Grande Absinthe, Herbe sainte, Herbe aux vers—; *Friuli* : Assinz, Sinz—; *Genoa* : Bonmegu, Erba medgu—; *German* : Aelsch, Allsam, Allsei, Alsam, Alsch, Alsen, Baermede, Bitteralsen, Bitterbeifuss, Bitterkraut, Elch, Else, Elzkraut, Ilsem, Kampferkraut, Kittelkraut, Knoopvanalsen, Magenkraut, Malnit, Meelrasch, Pardehan, Pardesan, Vraemte, Waermde, Waermkraut, Warmuede, Wermde, Weissrauch, Wermuth, Wiegenkraut, Woerken, Woermd, Woermke, Wormeth, Wraemte, Wroembk, Wuermken, Wurmei, Wurmet, Wurmtod—; *Greek* : Apsidia, Apsinthia, Apsinthion, Apsinthos, Apsithea, Apsithia—; *Hindi* : Vilayatiafsantin—; *Italian* : Assenzio—; *Lombardy* : Incens, Incens de bigat—; *Malayalam* : Shulabandha—; *Malta* : Wormwood, Assenzio, Assenziu—; *Norwegian* : Malurt—; *Pacific Coast* : Absinthium, Madderwort, Mingwort, Oldwoman, Wormwood—; *Padua* : Bun maja—; *Pavia* : Assenzi—; *Persian* : Afsantin—; *Piedmont* : Bonme, Bonmi, Dusang, Erba meja, Erba mia, Fort, Incenso, Insens, Insens grousser, Medighdt, Ourtmia, Ourtmiglia—; *Potenza* : Naseienzo—; *Reggio* : Aluina, Alvina, Asseinzi—; *Romagna* : Absanta, Absent, Absent rumen, Absent dal foj lerghi—; *Roumanian* : Pelin—; *Russian* : Polin—; *Sanskrit* : Damar—; *Spanish* : Ajenjó, Doncel—; *Treviso* : Bon maistro—; *Tuscany* : Assenzo—; *Verona* : Medego maistro—.

2. **Artemisia annua** Linn. occurs in the Punjab, from Peshawar to Waziristan, ascending up to 5,500 ft. It spreads to Afghanistan, Indo-China, China, Siberia, and westwards to Hungary.

In China and Malaya the dried leaves and stalks are used in skin diseases. The herb is a popular medicine in Indo-China, where it is considered a good stomachic and diuretic, and is prescribed in jaundice and in skin diseases.

Chinese : Huang Hua Hao, Ch'ing Hao—; *Indo-China* : Che noi, Hoang hoa cao, Nhan tran—; *Malaya* : Ching hoh—.

3. **Artemisia caruifolia** Roxb. is found in eastern Bengal, Assam, Nepal, Burma, whence it extends over to China.

The toasted plant is much used medicinally in Annam. It is recommended for fevers, chronic diarrhoea, phthisis with emaciation, purulent scabies with ulcers, and intestinal troubles. Externally it is applied to wounds due to metallic instruments.

Annam : Cay thanh hao, Co thanh hao, Ran hao, Thanh cao, Thanh hao—.

4. **Artemisia Dracunculus** Linn. is found in Western Tibet and in the western Himalaya at altitudes of 14,000-16,000 ft. It is distributed to Afghanistan, Western Asia, South and Mid Russia.

The aromatic leaves are credited with aperient, stomachic, stimulant, and febrifuge properties.

Dutch : Dragon— ; *English* : Little Dragon Mugwort, Tarragon— ; *French* : Dragon, Dragonne, Estragon, Fargon, Herbe au dragon, Herbe dragonne— ; *German* : Dragun, Kaisersalat— ; *Italian* : Dragontea— ; *Portuguese* : Estragao— ; *Roumanian* : Tarhon— ; *Russian* : Estragon— ; *Spanish* : Dragoncillo, Estragon—.

5 **Artemisia maritima** Linn., in its many variations of forms, has an extremely wide distribution in the northern hemisphere of the Old World, occurring mostly in saltish soils. It is found in the salt plains of Western Tibet, where it grows in abundance and ascends up to 9,000-14,000 ft. It occurs at an altitude of 7,000-9,000 ft. in the Western Himalaya from Kashmir to Kumaon. It covers immense tracts in Northern Asia from Chinese Mongolia to Central Siberia, the region of the Caspian, and Southern Russia. It is found on saline soils in Hungary, on the coasts of the Baltic, of France and the Mediterranean, and in the salt marshes of the British Isles. In Britain it spreads as far as Wigton on the West and Aberdeen on the East; it also thrives in north-east Ireland and in the Channel Islands.

The medicinal properties of the plant are those of a slight tonic, inferior in efficacy to common wormwood; and it is not often employed except in discutient and antiseptic fomentations, for inflammations, tumours, and foul ulcers; where its topical application has been thought beneficial. It is still often made use of by country people for intermittent fever.

In Southern Afghanistan and Baluchistan the plant is much used as an antiperiodic. An infusion, and also decoction, of the fresh plant has been very successfully used in cases of ague, intermittent and remittent fever.

At Kirani, near Quetta, the plant is given to children for stomach-ache; at Sanjawi it is a cure for jaundice.

In Bombay, the Hakims prescribe it in doses of 2 to 3 drachms as an anthelmintic, and also deobstruent and stomachic tonic. In the form of a poultice, they use it to relieve the pain caused by the bites of scorpions and venomous reptiles. But Mhaskar and Caius have successfully demonstrated that, whether it be snake bite or scorpion sting, the treatment is useless.

The flower-heads are collected from the villages around Teheran and sold as a vermifuge. There is little doubt that they were used by the Greeks and Romans to expel intestinal worms, and it is a matter of certainty that Arabian and Persian physicians have always prescribed them as an anthelmintic. During the war both seeds and leaves were tried and found to be effective. Later Simonsen examined the leaves and flowering tops of *A. maritima* (*A. brevifolia* Wall.) growing in Chitral, Afghanistan, and Baluchistan, and obtained from 0 to 1 per cent of santonin, the amount being greater when the flowers are just appearing.

Arabic: Afsanthinulbarh, Sarifun, Sariqun, Shih, Shiharmani—; *Bhotia*: Sefedpurcha—; *Bombay*: Kiramaniova—; *Catalan*: Donsell mari—; *English*: Drooping Sea Wormwood, English Sea Wormwood, French Sea Wormwood, Levant Sea Wormwood, Roman Wormwood, Santonica, Sea Mugwort, Sea Wormwood, Wormseed—; *French*: Absinthe maritime, Armoise maritime—; *Gujerati*: Chhuvariajamoda, Kirmanidinechi—; *Hindi*: Ajavayana, Chhuari—, *Indo-China*: Chi nai—; *Kirani*: Zher—; *Marathi*: Kirmaniova, Surabandi—; *Persian*: Afsanthinulbarh, Darmaneh, Sariqun, Shih—; *Sanjawi*: Tarkhasperah—; *Sanskrit*: Chhara, Chauhara, Gandha, Jantunashana, Khurapushpika, Parasi, Yavani, Yavaniya—; *Spanish*: Ajengo maritimo—; *Teheran*: Dharmane—; *Urdu*: Darmanah—.

6. **Artemisia persica** Boiss. is found at 9,000-14,000 ft. in Western Tibet, whence it extends to Afghanistan, Southern Persia, and Kurdistan.

The plant is used as a tonic, febrifuge, and vermifuge.

Arabic: Afsantinulbarh, Sariqun, Shih—; *Gujerati*: Pardesidauno—; *Marathi*: Davana—; *Persian*: Afsantinulbarh, Sariqun, Shih—.

7. **Artemisia sacrorum** Ledeb. occurs in Western Tibet and Kunawar. It is found in Kumaon on the interior ranges bordering Tibet between 10,000 and 12,000 ft. It extends to Dahuria, Siberia, Central and South Russia.

The plant is given to horses in affections of the head.

Bhotia: Kalapurcha—; *Ladak*: Burmack, Tatwen—; *Punjab*: Burnak, Chumbar, Jau, Munya, Niurtsi, Tatwen, Zbur—.

8. **Artemisia scoparia** Waldst. and Kit. occurs in Western Tibet at altitudes of 7,000-12,000 ft., in the Western Himalaya from Kashmir to Lahul at 5,000-7,000 ft., in Sind, in the Punjab, in the Upper Gangetic Plain. Eastwards it extends to China and Japan, westwards to Afghanistan and Central Europe.

In the Punjab the infusion is given as a purgative, and the smoke is considered good for burns.

At Las Bela the plant is used as a cure for pain in the ear.

Baluchi: Gwatag—; *Bombay*: Churisaroj, Danti—; *Brahui*: Jir, Khisunjir, Luling—; *Las Bela*: Gajar—; *Punjab*: Biur, Dona, Durunga, Jhan, Lasaj, Marua, Pilajau—.

9. **Artemisia Siversiana** Willd. is found at 8,000-10,000 ft. in the Western Himalaya from Kashmir to Lahul, and at 12,000-14,000 ft. in Western Tibet. It extends to China whence it spreads westwards to South Russia.

The plant is much used in India where it is considered tonic, deobstruent, febrifuge and anthelmintic. It is applied externally as a discutient and antiseptic.

The hakims prescribe the drug freely.

The plant is also held in great esteem by the vaids and its place in Ayurveda is undisputed.

Arabic : Afsantin— ; *Bengal* : Dana, Dona— ; *Bombay* : Downa— ; *Canarese* : Davana— ; *Gujerati* : Damro— ; *Hindi* : Dauna— ; *Marathi* : Davana, Ranadavana— ; *Persian* : Afsantin— ; *Sanskrit* : Agnidamanaka, Bahukantaka, Brahmajata, Damana, Damanaka, Damani, Dandi, Danta, Devashekhara, Gandhotkata, Guchhaphala, Jatila, Kshudradussparsha, Kshudrakantakari, Kulapatra, Kulapatraka, Madanaka, Muni, Munipatra, Panduraga, Patri, Pavitraka, Pundarika, Pushpachamara, Tapasaptri, Tapaswipatra, Tapodhana, Vanadamanaka— ; *Urdu* : Afsantin—.

10. **Artemisia vulgaris** Linn. is found throughout the mountainous districts of India, ascending up to 5,000-12,000 ft. in the Western Himalaya, and up to 5,000-8,000 feet in Sikkim, the Khasia, Ava and Martaban Mountains. It grows at Mount Abu, in Marwar, and on the Western Ghats, from the Konkan southwards to Ceylon. It extends to temperate Europe and Asia, to Siam and Java.

The herb has emmenagogue and antispasmodic properties; the root is tonic and antispasmodic.

The plant is considered to be a valuable stomachic, deobstruent, and antispasmodic; it is prescribed in infusion and electuary in cases of obstructed menses and hysteria. Externally it is used in fomentations given in skin diseases and foul ulcers as an alterative.

The expressed juice is used in diseases of children. It is applied to the head of young children for the prevention of convulsions.

The leaves and tops are administered in nervous and spasmodic affections connected with debility, in asthma and diseases of the brain. In Persia, in Afghanistan, and throughout India, a strong decoction is given as a vermifuge, and a weak one to children in measles. An infusion is given as a tonic.

The plant is much used medicinally in Indo-China, where the leaves and the flowers are considered as aromatic, emmenagogue, stomachic, antispasmodic, and anthelmintic. The boiled leaves are used as a poultice in headache; dried and cut into small fragments they are used to cauterize wounds.

In China, Japan and Indo-China inflammable cones or 'moxa' are obtained by grinding the leaves in a stone mortar with water, separating the coarser particles, and drying what remains. Moxibustion, or the method of cauterizing the skin by burning, is resorted to for a very large number of diseases, from itch to sterility.

In Annam the leaf is used in haemorrhage: epistaxis, blood vomiting, haematuria. It is also recommended for metrorrhagia, dysentery, intestinal and urinary troubles. It is highly praised as a vermicide. It is used in eczema, herpes, and purulent scabies. In Malaya the leaves are employed as a carminative and haemostatic.

The tonic and stomachic properties of the plant are well known in the Philippine Islands. An infusion of the leaves is commonly used as an emmenagogue.

The plant is prescribed by Sushruta in the treatment of snake bite and scorpion sting; but that the plant is not an antidote to either snake or scorpion venom has been experimentally demonstrated by Caius and Mhaskar.

Anglo-Saxon: Wyrmwyrt—; *Annam*: Bang dai, Benh thao, Cuu thao, La ngai, La ngai cao, La ngai cuu, La thuoc cuu, Ngai diep, Thuoc cuu, Y thao—; *Arabic*: Isferaj—; *Bombay*: Nagdona—; *Canarese*: Davana, Manjipatri—; *Catalan*: Altimira—; *Chinese*: Ai—; *Deccan*: Dawan, Randawan—; *Dehra Dun*: Samri, Sarmi—; *Dutch*: Bijvoet, Sint Jans Gordel, Sint Jans Kruid—; *English*: Felon Herb, Felon Wort, Fleabane, Indian Wormwood, Maidenwort, Motherwort, Mugwort, St. John's Plant—; *French*: Armoise, Artémise, Ceinture de Saint Jean, Couronne de Saint Jean, Encens, Encens de mas, Fleur de Saint Jean, Herbe à cents gouts, Herbe de la Saint-Jean, Herbe de Saint Jean, Herbe Saint Jean, Remise—; *German*: Alsei, Beifuss, Beiposs, Besenkraut, Bibes, Biboth, Bibs, Biefoth, Biermersch, Buck, Budschen, Kampferkraut, Roterbock, Sant Johannis Guertel, Weiberkraut, Wiegenkraut, Wiesenkraut, Wildes Wurmkraut, Wurmtod—; *Garhwal*: Kunja—; *Greek*: Artemisia—; *Guam*: Yerba de Santa Maria—; *Hindi*: Dona, Gathivana, Majtari, Mastaru, Mastru, Nugduna—; *Indo-China*: Cuu ngai da, Lau cao, Ngai, Ngai cuu, Thuoc cau, Thuoc cuu, Yomogi—; *Italian*: Amarella, Artemisia, Canapaccia, Assenzio di siepe—; *Japanese*: Yomogi—; *Malaya*: Ai, Chi ai, Khee ngai, Ki ai, Ngai—; *Malayalam*: Appa, Damanakam, Kattuchatti, Makkippu, Mashipatri, Nilampala, Rirunittipacha—; *Marathi*: Gathona, Surband—; *Nepal*: Titapat—; *Pacific Coast*: Common Mugwort, Felon-herb, Green Ginger, Motherwort—; *Persian*: Absanthin, Absentin, Afsantin, Afsintin rumi—; *Philippines*: Santa Maria, Yerba de Santa maria—; *Punjab*: Afsuntin, Banjiru, Buimadaran, Chambra, Puujan, Tarkha, Tataur, Ubusha—; *Roumanian*: Pelin negru, Pelinita—; *Russian*: Cherdonilnik—; *Sanskrit*: Barha, Barhikusum, Barhipushpa, Granthika, Granthiparna, Granthiparnaka, Guchhaka, Gutthaka, Kakapushpa, Kūkura, Nagadamani, Nilapushpa, Saraparni, Shuka, Shukabarha, Shukachhada, Shukapuccha, Sthauneya, Sugandha, Svaramaguchhaka, Tailaparnaka, Vnyadamanaka, Vishirnakhya—; *Saora*: Adavidhavanamu—; *Spanish*: Artemisa, Artemisia—; *Tagalog*: Camaria, Tinisas—; *Tamil*: Mashibattiri, Tirunama—; *Teheran*: Absint—; *Telugu*: Davanamu, Mashipatri—; *Uriya*: Doyona, Gonddhomaro, Nagodoyona—.

ASTER

The genus includes 400 species inhabiting mostly the northern temperate regions of the world.

The following species are used medicinally in China—*A. fastigiatus* Fisch. and Max., *A. scaber* Thunb., *A. tataricus* Linn. f., *A. trinervius* Roxb.—; in Indo-China—*A. tataricus* Linn., *A. trinervius* Roxb.—; in South Africa—*A. erigeroides* Harv., *A. filifolius* Vent., *A. hispidus* Bkr., *A. serrulatus* Harv.—; in California—*A. puniceus* Linn.—

Aster trinervius Roxb. occurs in the Central and Western Himalaya, Nepal, Sikkim at 5,000—7,000 ft., the Mishmi Mountains, the Khasia Hills at 3,000—6,000 ft. Thence the plant spreads over to North China and Japan.

The Chinese use the root for coughs and pulmonary affections, and in the treatment of malaria and haemorrhages.

Cantonese: Tsz uen—; *Chinese*: Ma Lan—; *Indo-China*: Ma lan—; *Malaya*: Tsz yoon—.

BIDENS.

The genus includes 150 cosmopolitan species, chiefly American.

B. bipinnata Linn. is used medicinally in West Africa; *B. pilosa* Linn. in China, Indo-China, North America, Brazil, Gold Coast, Kenya, Tanganyika, and South Africa; *B. tripartita* Linn. also is used in China, and *B. graveolens* Mart. in Brazil.

Achenes cuneiform, tip truncate ... ... 2. *A. tripartita.*
Achenes long, slender, narrowed from the middle to the top. 1. *A. pilosa.*

1. **Bidens pilosa** Linn. is found throughout India, Ceylon, and most of the warm countries.

In Indo-China the dried flower buds ground and mixed with alcohol are used as a mouth wash in toothache. For sore eyes the pounded leaves are applied over the eyelids.

In Gold Coast and in Lagos the juice of the leaves is commonly squeezed into the eyes or the ears to cure eye complaints or ear complaints. In the latter case the leaves are first warmed in water with pepper. It is also used as a styptic to stop bleeding from a wound.

The Zulus chew the young shoots for the treatment of rheumatism. They also administer the powdered leaf in water as an enema for abdominal troubles and rub the burnt seeds into incisions on the sides for the relief of pain. The flower is a remedy for diarrhoea, and an infusion of the leaf and root a remedy for colic.

The leaves are used in Brazil as a styptic in stopping the flow of blood, and as a vulnerary. They are applied to foul ulcers and swollen glands. In Colombia the infusion is used as a sudorific.

Afrikaans: Duivelskerwel, Wevenaar—; *Antioquia*: Masiquia—; *Australia*: Black Fellows—; *Bogota*: Chipaca—; *Ceylon*: Ottupillu—; *Chinese*: Kuei Chen Ts'ao—; *English*: Beggar Ticks, Bur Marigold, Spanish Needles, Sweethearts—; *Ewe*: Dzani pipi—; *Gold Coast*: Black Jack—; *Gujerati*: Phusiun, Samarakokadi—; *Iloilo*: Tubactubac—; *Indo-China*: Cuc ao, Quay cham thao, Tu to hoan—; *Kikuyu*: Michegi—; *Krepi*: Adzrorkpii—; *Krobo*: Dsetshi—; *Lagos*: Abere oloko, Akesinmaso—; *Lepcha*: Mung-gu tuk-tsong, Tuk-tsong mungayap—; *Malay*: Rumput juala—; *Mano*: Zikilli wissi—; *Mauritius*: Villebague—; *Mende*: Tombolo, Tombo-makei—; *Meru*: Rathangi—; *Nandi*: Kipkoleit—; *South Africa*: Beggarsticks, Black Jack—; *Suto*: Moonyane—; *Timne*: Ebamp—; *Twi*: Ananse mpaane, Dwirantwi, Gyinantwi—; *Yoruba*: Abere-oloko—; *Zulu*: uQadolo—.

2. **Bidens tripartita** Linn. occurs in Western Tibet, and in the marshes of Central and Western Himalaya from Nepal to Kashmir at altitudes of 3,000-5,000 ft. It is distributed to Northern Asia and Japan, and westwards to North Africa, Western Europe, and North America.

The Chinese use the plant in chronic dysentery and for eczema.

Chinese: Lang Pa Ts'ao—; *English*: Bur Marigold, Water Agrimony—; *Greek*: Agria katephedia—.

BLUMEA.

The genus is eminently characteristic of India, and the species may be called the Groundsels of that country. The species number about 80; they are tropical and subtropical Asiatic, African, and Australian.

B. aurita DC. is used medicinally in Gold Coast.

A. Heads many, villous, small. Leaves thick, fomentose beneath ... ... 5. *B. lacera.*
B. Heads few, small, on long slender peduncles of dichotomous cymes ... ... 4. *B. eriantha.*

C. Heads very numerous, large or small. Leaves very large.
  1. Pappus white ... ... 2. *B. chinensis.*
  2. Pappus red
    a. Tall shrub, camphoraceous. Leaves thick usually silky above ... ... 1. *B. balsamifera.*
    b. Leaves 8-18 in. long, very woolly white beneath puberulous above ... ... 3. *B. densiflora.*
    c. Leaves 6-10 in. long, stiff, shining, quite glabrous ... ... 6. *B. myriocephala.*

1. **Blumea balsamifera** DC. is easily recognised by its strong smell of camphor. It is found in Tropical Himalaya, Nepal, Sikkim at 1,000-4,000 ft., Assam, the Khasia Hills, Chittagong, and Burma. It is very common in open places in the whole Malay Peninsula. It is also common in Java.

A warm infusion acts as a pleasant sudorific, and the decoction is a useful expectorant.

In Indo-China the leaves are considered to be stomachic, and antispasmodic, and they are used in leucorrhoea. In Cambodia they are used externally in scabies.

Taken internally the decoction of the leaves is an excellent diaphoretic in bronchitis. In Java and China it is given as an expectorant. It is stomachic, antispasmodic, emmenagogue, antiseptic. As a fumigation it is much used in the Philippine Islands for rheumatism and headache.

The leaves are officinal in Holland.

Burma: Ponmathein—; *Cambodia*: Baimat—; *China*: Ai Na Hsiang—; *Dutch India*: Semboeng octan—; *English*: Nagal Camphor—; *French*: Camphrée—; *Gujerati*: Kalahad—; *Hindi*: Kakaronda—; *Ilocano*: Sobsob—; *Indo-China*: Bai mat, Dai bi, Tu bi xanh—; *Malay*: Chapa, Chapu, Sembong—; *Marathi*: Bhangaruda—; *Pampangan*: Sambon—; *Tagalog*: Sambon, Sambong, Sambung—; *Visayan*: Alibhon, Alibun, Ayoban, Gabuen, Gintingintin, Guintinguintin, Guitinguitin, Hamlibon, Lacadbulan, Lacdanbulan, Lalacdan—.

2. **Blumea chinensis** DC. is found in the Eastern Himalaya, Sikkim and Bhutan at 2,000—4,000 ft., Assam, the Khasia Hills, and Penang. It is not rare in the woods of the Malay Peninsula, whence it spreads over to Java and Southern China.

The leaves or leafy stalks are used in Malaya as a stomachic, antispasmodic, and diaphoretic.

Chinese: Ghin Li Ming—; *Malaya*: Kow lee meng, Tombak-tombak—.

3. **Blumea densiflora** DC. occurs in Tropical Himalaya, Sikkim, Assam, the Mishmi, Naga, and Khasia Hills at altitudes of 2,000—4,000 ft. It is found in Tavoy, and extends to the Malay and Fiji Islands.

The plant yields camphor. Its leaves are occasionally used as a sudorific.

Burma: Phummasin, Pungmatheing—.

4. **Blumea eriantha** DC. is found in Bundelkhand, Konkan, Deccan, the Western Ghats, the South Mahratta Country. It probably occurs on the West Coast of the Madras Presidency.

The juice of the plant is administered as a carminative, and the herb used along with the leaves of *Vitex Negundo* and *Careya arborea* for fomentations. A warm infusion is given as a sudorific in catarrhal affections, cold it is considered to be diuretic and emmenagogue.

Marathi : Nimurdi—.

5. **Blumea lacera** DC. occurs throughout the plains of India, from the north-west ascending to 2,000 ft. in the Himalaya, to Travancore and Singapore. It is a common roadside weed in Ceylon and Malaya. It is distributed to the Malay Islands, Australia, China, and tropical Africa.

The plant is described by Ayurvedists as hot, pungent, and bitter; antipyretic; good for bronchitis, diseases of the blood, fevers, thirst, and burning sensations. The root kept in the mouth is said to cure diseases of the mouth.

In the Konkan the plant is used to drive away fleas and other insects. It is prescribed as an antiscorbutic in West Africa.

The root mixed with black pepper is given in cholera.

The expressed juice of the leaves is used as an anthelmintic, febrifuge, astringent, and diuretic; mixed with black pepper, it is given in bleeding piles.

Arabic : Kamafitus—; *Bengal* : Burasuksung, Kukurmuta, Kukursunga—; *Bombay* : Nimurdi—; *Burma* : Maiyagan—; *Deccan* : Divarimulli, Janglikasni, Janglimulli—; *Golungo Alto* : Quitoco antiscorbutico—; *Gujerati* : Kalhar, Kokarunda, Pilo kapurio—; *Hindi* : Janglimuli, Kakronda, Kukkurbanda—; *Konkan* : Numurdi—; *La Reunion* : Lastron bâtard—; *Malay* : Lumai hitam—; *Marathi* : Bhamurda, Kukurbanda—; *Mundari* : Marangkuru—; *Porebunder* : Kapurio, Pilichanchadamari—; *Sanskrit* : Kukkuradru, Kukundara, Mriduchhada, Sukshmapatra, Tamrachuda—; *Tamil* : Kattumullangi, Narakkarandai—; *Telugu* : Advimulangi, Karupogaku—.

6. **Blumea myriocephala** DC. is found in the Sikkim Himalaya at an altitude of 2,000 ft., in Assam, Chittagong, Sylhet, and Burma. It occurs in the mountain forests of the Malay Peninsula.

The leaves are used as a sudorific in Indo-China; they are given in bronchitis and in aphthae.

Indo-China : Xang song, Xuong song—.

BOLTONIA.

The genus consists of 12 North American and North subtropical Asiatic species.

Boltonia indica Benth. is found in the Khakyen Hills of Upper Burma. It extends to China and the Malay Islands.

In Indo-China the plant is considered tonic, stomachic, and antipyretic.

Indo-China : Hai nhi cuc—.

CALENDULA.

The genus includes 15 species, natives of Central Europe and the Mediterranean region, as far as India, the Canaries; cultivated and naturalised elsewhere.

Ligules sulphur-coloured; achenes all curved, marginal dorsally echinate beaked, inner dorsally muricate ...	1. *C. arvensis.*
Ligules many, bright orange yellow; achenes all curved boat-shaped dorsally muricate not beaked, outer larger ventrally crested scarcely beaked	2. *C. officinalis.*

1. **Calendula arvensis** Linn. is a doubtful native of India; found in Kashmir; distributed over Western Asia and Southern Europe; naturalised in South America, Australia and Japan.

The plant is used medicinally in Spain; the leaves are considered sudorific; the flowers are reputed stimulant, antispasmodic, and emmenagogue.

Catalan: Galdirons, Llevagat, Llevamal, Llevamans—; *French*: Petit souci, Souci des champs, Souci des vignes—; *Malta*: Field Marygold, Calendula, Calta, Fior-rancio, Suffeira—; *Spanish*: Calendula silvestre, Flor de cada mes, Maravilla silvestre, Yerba del podador—.

2. **Calendula officinalis** Linn. is a native of the Mediterranean introduced in India and run wild. It is found in the fields of Punjab and Sind, extending to Afghanistan and westwards to South Europe.

The plant is signally valued for healing wounds, ulcers, burns, and other breaches of the skin surface; it is a precious vulnerary. The dried florets are vulnerary, antiemetic, bitter tonic, febrifuge, anthelmintic, and stimulant to wounds and ulcers.

The plant, especially its flowers, was used on a large scale by the American surgeons to treat wounds and injuries sustained during the last civil war, and obtained their warmest commendation. It quite prevented all exhausting suppurative discharges and drainings.

In Europe the herb is chiefly used as a local remedy. Its action is stimulant and diaphoretic. Given internally, it assists local action and prevents suppuration. The infusion of one ounce to a pint of boiling water is given internally, in doses of a tablespoonful, and externally as a local application. It is useful in chronic ulcer, varicose veins, etc. The plant was formerly considered to have much value as an aperient and detergent in visceral obstructions and jaundice.

The leaves, eaten as a salad, have been considered useful in the scrofula of children. The expressed juice has been given in cases of costiveness and proved very efficacious. Snuffed up the nose it excites sneezing and a discharge of mucus from the head. It has also been found useful as an extirpator of warts.

It has been asserted that a flower, rubbed on the affected part, is an admirable remedy for the pain and swelling caused by the sting of a wasp or bee. A lotion made from the flowers is most useful for sprains and wounds, and a water distilled from them is good for inflamed and sore eyes.

An infusion of the freshly-gathered flowers is employed in fevers, as it gently promotes perspiration and throws out any eruption—a decoction of the flowers is much in use among country people in England as a posset drink in measles and smallpox, a widely administered remedy and one of the few which everybody seems to know. Marigold flowers are in great demand for children's ailments.

Druggists now make a medicinal tincture which is advised as a sudorific stimulant in low fevers, and to relieve spasms. A saturated tincture of the flowers, when mixed with water, promotes the cure of contusions, wounds, and simple sores or ulcers; also the extract will allay chronic vomiting. One drop of the tincture with two grains of powdered borax when sprayed into the ear is very useful if a discharge has become established therefrom.

Anglo-Saxon : Merso-meargealla—; *Burma* : Htattaya—; *Catalan* : Clavellina de mort, Clavellines de mort, Gojato, Gojats, Graugets—; *Chinese* : Chin Chan Ts'ao—; *Danish* : Almindelige koeblomme—; *Dutch* : Afrikaantje goudsbloem, Goudsbloem, Tamme goudeloem—; *English* : African Marigold, Calendula, Common Marigold, Garden Marigold, Golds, Marigold, Mary Gowles, Pot Marigold, Ruddes—; *French* : Fleur de tous les mois, Souci, Souci cultivé, Souci des jardins—; *German* : Butterblume, Dannblaume, Dotterblume, Faerberblume, Gaehl, Gaehlgoelling, Gartringel, Gelken, Gilkenblume, Goeldeke, Goelling, Goldblume, Goldrose, Gugelkopf, Hauswirbel, Huehnernelke, Ingblume, Kohlblume, Kolblume, Morgenroete, Rinderblume, Ringelblume, Ringelken, Ringelrose, Sonnenblume, Sonnenrose, Studentenblume, Totenblume, Wagenblume, Warzenkraut, Wegroeslein, Zunenwirvel—; *Greek* : Chamobyoreta—; *Italian* : Calendula, Calendula ortense, Fiori d'ogni mese, Fiorrancio, Furrancio—; *Kurdish* : Hamaishabahar—; *Pacific Coast* : Garden Marigold, Goldbloom, Holligold, Marigold, Mary-bud—; *Polish* : Nogieter—; *Portuguese* : Calendula ortense, Maravilha bastarda—; *Punjab* : Aklelulmulk, Saldbargh, Zergul—; *Roumanian* : Galbinele, Hilimica—; *Russian* : Nogotki—; *Spanish* : Calendula, Calendula officinal, Flor del muerto, Flor de muerto, Maravilla, Mercaderes dorados, Mercaderes reales—; *Swedish* : Ringblomma—; *Turkish* : Qarah koz—; *Uruguay* : Flor de la virreina—; *Yemen* : Zobedje—.

CARDUUS.

The genus includes about 80 species, natives mostly of the Mediterranean region, but extending from Europe to Japan.

C. crispus Linn. is used medicinally in China, *C. nutans* Linn. in India.

Carduus nutans Linn. is found in Western Tibet at an altitude of 13,000 ft., in the Western Himalaya from Kashmir to Simla, and in the Punjab. It extends to Northern Asia and westwards through Baluchistan and Persia to North Africa and Western Europe.

The flowers are considered febrifugal in Sind and in the Punjab. In Kashmir they are used to purify the blood.

English : Musk Thistle, Nodding Thistle—; *Kashmir* : Gulibadaward—; *Punjab* : Badaward, Kanchhari, Tiso—; *Urdu* : Gulebadáward—; *Uruguay* : Cardo—.

CARPESIUM.

The genus consists of about 10 species in South Europe and in temperate and subtropical Asia.

Leaves subsessile, never truly petioled, lanceolate acuminate quite entire or serrate. Heads subsessile inserted along the whole length of the branches	1. *C. abrotanoides.*
Leaves shortly petioled elliptic-lanceolate obtuse sinuate-toothed. Heads terminal drooping with broad leafy bracts.	2. *C. cernuum.*

1. **Carpesium abrotanoides** Linn. is found in the Temperate Himalaya, from Kashmir at 5,000-1,000 ft. to Sikkim at 8,000-10,000 ft. It is distributed to North Persia and Austria, and to China and Japan.

The root, the leaf, and the seed are used medicinally in China. They are said to be diuretic and anthelmintic.

In Indo-China the seeds are considered laxative and bechic.

Chinese : Hao Shih, T'ien Ming Ching— ; *Indo-China* : Cau nhi thai, Thien mong tong—.

2. **Carpesium cernuum** Linn. is one of the commonest and most variable Himalayan plants. It abounds in the Temperate Himalaya, the Khasia Hills, and the Nilghiri Mountains. It is distributed from the Caucasus to France, Java, and Japan.

The herb is used in China as an astringent, diuretic, and anthelmintic.

Chinese : Ho Shih—.

CARTHAMUS.

The genus includes about 25 species, natives of the Mediterranean region, Central Europe, India, Abyssinia and the Canaries.

A. Pappus made of scabrous toothed scales, the inner ones being thrice as long as the achene	1 .*C. lanatus.*
B. Pappus absent.	
1. Leaves entire and unarmed or spinulose-serrate	3. *C. tinctorius.*
2. Leaves oblong or oblong-lanceolate; lower shortly spinulose-toothed, upper half-amplexicaul, very spinous	2. *C. oxyacantha.*

1. **Carthamus lanatus** Linn. is found in Kashmir at 5,000—6,000 ft. It occurs in the Mediterranean region, Central Europe, Abyssinia, Madeira, the Canaries.

The plant is used medicinally in France as a sudorific, febrifuge, and anthelmintic.

English : Blessed Thistle, Distaff Thistle, Woolly Carthamus, Yellow Distaff Thistle— ; *French* : Carthame laineux, Chardon bénit des Parisiens— ; *Maltese* : Xeuk il far, Xeuc ta Cristu—.

2. **Carthamus oxyacantha** Bieb. occurs in the Punjab, whence, through Baluchistan and Afghanistan, it extends westwards to the Caucasus.

The oil extracted from the seeds is used medicinally in the Punjab as a dressing for bad ulcers and as a remedy for itch.

English: Wild Safflower—; *Hindi*: Kantiari, Karar, Kharara, Poli, Polian—; *Iraq*: Kassub asfar, Suffair, Summaina—.

3. **Carthamus tinctorius** Linn. is cultivated throughout a large part of India, Afghanistan, Persia, Syria, Egypt, and Southern Europe.

This plant is the Kusumbha of Sanskrit writers, a well known Hindu medicinal drug.

Mahomedan writers too ascribe many virtues to the plant. The action of the flowers is laxative and diaphoretic. In domestic practice these flowers are used in children's and infants' complaints—measles, fevers, and eruptive skin complaints. An infusion is made of ½ oz. of the flowers to a pint of boiling water taken warm to produce perspiration.

In China and Indo-China the flowers are given in dysmenorrhoea and paralysis as a tonic and emmenagogue. In the Philippine Islands they are employed as a cure for jaundice.

The powdered seeds made into a poultice, are used to allay inflammation of the womb after childbirth. In Sind they are employed as a cooling medicine; they are sometimes boiled and made into a gruel. They are considered to be diuretic and tonic by the natives of the Punjab. In China and Indo-China they are reputed purgative.

Koman in Madras administered a decoction (1 in 20) of the powdered seeds to cases of constipation. The action was very mild, and in the majority of cases it did not produce the desired effect.

The oil from the seeds is considered a mild purgative in Sind. It is used as a dressing for bad ulcers, and as a liniment in rheumatism. In Bengal it is considered by the ryots as a valuable remedy for itch; a cure is said to be effected after three to six applications. The charred oil is used for healing sores and for rheumatism; as a veterinary medicine it occasionally finds use in healing sores on cattle.

The young green plant is said to be very efficacious in colds; it is believed to keep the system warm.

Safflower, in combination with other drugs, is prescribed for scorpion sting; but Caius and Mhaskar have experimentally shown that it is not an antidote to scorpion venom.

Arabic: Akhariza, Bazr-el-abris, Hab-ul-asfar, Hariz, Kirtum, Kurtum. 'Usfar, Za'faran—; *Bengal*: Kajirah, Kusamphul, Kusum, Kusumbha—; *Bombay*: Kardai, Karophi, Kusumba—; *Burma*: Heboo, Hshu, Su, Suban, Supan—; *Canarese*: Kossumba, Kusambe, Kusumba—; *Catalan*: Safrá bort, Safranó—; *Chinese*: Hong Hoa, Hong Lan Hoa, Hung Lan Hua—; *Cutch*: Kusumba—; *Dutch*: Basterd Saffraan, Wilde saffraan—; *Deccan*: Kusumb—; *Egypt*: Gartoom, Kurtim, Osfar, Qortom—; *English*: African Saffron, American Saffron, Bastard Saffron, Dyer's Saffron, Fake Saffron, Parrot Seed, Safflower, Wild Saffron—; *French*: Carthame, Cnique, Safran bâtard, Safran d'Allemagne, Safranon, Carthame des teinturiers, Safran faux—; *German*: Gartensafran, Falschesafran, Farberdistel, Safflor, Wildersafran—; *Greek*: Atractos, Atractylis, Knikos—; *Guilan*: Tokhme-Kafisheh, Tukm-i-kajrah, Tukm-i-kazirah—; *Gujerati*: Karada, Kusumbo—; *Hamadan*: Kaufsha, Qushon—; *Hindi*: Barre, Karrah, Kasumba, Kussum, Kusumba—; *Indo-China*: Daccam, Hong hoa, Hong lam hoa, Rum—; *Iraq*: Qurtum—; *Italian*: Cartamo, Croco ortense, Zafferano saracinesco, Zaffrone—; *Konkani*: Kusbo—; *Languedoc*: Grano de perrouquet—; *Malaya*: Hong fah, Hsi hung hua, Hung hua, Hung lan hua, Sai hong fah—; *Malayalam*: Chendurakam—; *Malta*: Bastard Saffron, Zafferanone, Ghosfor—; *Manipur*: Galapmachu—; *Marathi*: Kadaya, Kararhi, Kardai, Kasdi, Kurdi, Sadhi—; *Mauritius*: Carthame, Safran bâtard—; *North-Western Provinces*: Barre, Kar—; *Oceania*: Kassoumbo—; *Pampangan*: Cachumba, Casubha, Castumba—; *Persian*: Gulekafshah, Gulemaskar, Kasakdanah, Kazhirah, Muasfir, Quortum—; *Philippines*: Azafran de la tierra—; *Portuguese*: Acafrao, Cartamo—; *Punjab*: Kar Karar, Kasumbha, Kurtam, Kusam, Kushumbha, Ma, Safir—; *Rajputana*: Bundi—; *Roumanian*: Brandusa de tvámna—; *Russian*: Saflor—; *Sanskrit*: Agnishikha, Gramyakunkuma, Kamalottara, Kamlottama, Kukkutashikha, Kusumbha, Lohita, Maharajana, Padmottara, Papaka, Pita, Rakta, Vanishikha, Vasraranjana—; *Sind*: Khoimbo, Quortum—; *Spanish*: Alazor, Azafran bastardo, Azafran romi, Azafranillo de Mejico, Azafranillo de papagayos—; *Sudan*: Essfar, Kurtum—; *Swedish*: Saffler—; *Syria*: Kashni—; *Tagalog*: Biri, Casabha, Casubha, Castumba, Catsumba, Lago—; *Tamil*: Chendurukam, Kusumba, Sendurgam—; *Telugu*: Agnisikha, Kushumba, Kusumbha—; *Turkish*: Kantawaras—; *Urdu*: Karha, Kusum—; *Uruguay*: Azafran bastardo, Azafran falso—; *Visayan*: Casabha—.

CENTAUREA.

The genus includes 600 species, mostly natives of the Mediterranean region, Central Europe and Western Asia, with a few North and South American and one Australian. The *Centaurea* are immigrants from the west into India and, except perhaps for *C. iberica* Stev. and *C. phyllocephala* Boiss. are visitors rather than even denizens.

C. calcitrapa Linn., *C. Centaurium* Linn., *C. cyanus* Linn., *C. jacea* Linn., *C. montana* Linn. are used medicinally in Europe; *C. Behen* Linn. in Persia; *C. alexandrina* Del., *C. praecox* Oliv. and Hiern., *C. rhizocephala* Oliv. and Hiern. in West Africa.

C. solstitialis Linn. is reputed poisonous to live stock when mature.

A. Flowers blue ... ... 2. *C. cyanus*.

B. Flowers purple or pink, very rarely white.
  1. Involucral bracts with narrow membranous margins terminating in a long strong spreading spine with short lateral ones at its base ... ... 1. *C. calcitrapa*.
  2. Involucral bracts ovate-rotund and oblong, herbaceous, cucullate with hyaline tomentose membrane ... ... 3. *C. picris*.

1. **Centaurea calcitrapa** Linn. is found in the Punjab and Kashmir, ascending to 3,500 ft. It also occurs in Mysore. It extends to Asia Minor, Central and South Europe, North and Tropical Africa.

The Arabs apply the bruised leaves to the head in cephalalgia.

In Europe the powdered root has long been considered a cure for fistula and gravel, and the seeds are made into powder and drunk in wine as a remedy for stone.

Arabic: Morrer, Shok—; *Catalan*: Cart estrellat, Floravia, Herba espitlera—; *English*: Star Thistle—; *French*: Centaurée chausse-trappe, Chardon étoilé, Chausse-trappe—; *German*: Flockenblume, Sterndistel, Sternflockenblume—; *Italian*: Calcatrepo, Calcatreppo, Calcatreppola, Calcatrippa, Ipofesto, Ippofresto—; *Malta*: Caltrops, Star-thistle, Calcatreppola, Ippofesto—; *Spanish*: Abrojos, Cardo estrellado, Trepacaballos encarnado—.

2. **Centaurea cyanus** Linn. is found in corn fields and cultivated places of North-West India. It is distributed to the Caucasus and westwards to the Atlantic.

The florets are mildly astringent. A water distilled from them was formerly in repute for weak eyes; it was famous in France under the name of *Eau de Casse-lunettes.*

Quoth Culpepper: 'The powder or dried leaves of the bluebottle, or cornflower is given with good success to those that are bruised by a fall, or have broken a vein inwardly, and void much blood at the mouth'.

In modern herbal medicine the flowers are considered to have tonic, stimulant, and emmenagogue properties.

Catalan: Angelets, Blauets, Blauhet, Escombrera—; *Dutch*: Korenbloem—; *English*: Bachelor's Buttons, Blaver, Blaverole, Blawort, Blue Blawort, Blewball, Blewblow, Blueblaw, Blue-bonnets, Bluebottle, Bluebow, Blue-caps, Blue Poppy, Break-your-Spectacles, Brushes, Corn-binks, Corn Bluebottle, Corn-bottle, Corn Centaury, Cornflower, Cuckoo-hood, Hawdod, Hurt-sickle, Knobweed, Knotweed, Loggerheads, Thumble, Witch Bell, Witches' Thimble—; *French*: Aubefoin, Aubifoin, Aubiton, Aubitou, Barbeau, Barbot, Bavéolle, Blavelle, Blavéole, Blaverolle, Blavet, Blaveolo, Blavetta, Blavette, Bleuet, Bluet, Bluet des moissons, Boufa, Bouffa, Carconille, Casse-lunettes, Centaurée barbeau, Centaurée bleuet, Chevalon, Chevalot, Ciano, Cornaille, Cornillat, Cornille, Courcourille, Créconille, Fleur de Zacharie, Le Chevalier, Péréole, Pérole—; *German*: Blaue Kornblume, Kornblume, Roggenblume, Tremse, Ziegenbein—; *Italian*: Battisegola, Fiordaliso—; *Roumanian*: Albastrea, Dioc, Floarea griului, Ghioc, Sglavoc, Vinetea—; *Russian*: Vacilek, Vacilyok, Valoshky—; *Spanish*: Aciano, Azuleja, Azulejo, Escobilla, Flor celeste de sembrados, Flor del cielo español, Liebrecilla menor—.

3. **Centaurea picris** Pall. is found in Sind, Baluchistan, Afghanistan, the Levant, Central and Southern Russia, Siberia, and the Altai Mounts.

At Wad in Jhalawan the plant is pounded in water and used to cure worms. In Loralai it is a cure for wounds of sheep, used if wolves tear them.

Brahui: Talkh kah—; *Harboi Hills*: Tulkha—; *Loralai*: Kurakh—; *Wad*: Talkhakao—.

CENTIPEDA.

The genus numbers 5 species, inhabiting Chile, Madagascar, tropical Asia, and Australia.

Centipeda robicularis Lour. is found in moist places throughout the plains of India and Ceylon. It is distributed over Afghanistan, Eastern tropical Asia, Australia, and the Pacific Islands.

The plant, either whole or in parts, is used medicinally in India, China, the Philippine Islands, and New South Wales.

The powdered herb and the minute seeds are used as a sternutatory. The drug is administered in ozoena, headaches, and colds in the head. It is considered a hot and dry medicine, useful in paralysis, pains in the joints, and worms.

The Mundas of Chota Nagpur snuff the crushed plant in fevers and colds. In the Punjab the herb is boiled to a paste and applied to the cheeks in toothache.

Vyas and Sinha have shown that the herb contains an alkaloid, a glucoside, and traces of saponin; the watery extract increases the force of contraction of the frog's heart, prolongs the systole, and causes heart block in larger doses.

Arabic: Afkar, Makandash, Uffarkakudush—; *Bengal*: Chhikni, Hanchetagachha, Hanchuti, Mechitta, Nagdowana, Nakkchikni, Pachittie—; *Bombay*: Nagdowana, Nakkchikni, Pachittie—; *Chinese*: Shih Hu Sui—; *English*: Sneezeweed, Sneezewort—; *Gujerat*: Chhikani—; *Hindi*: Nagdowana, Nakchhikni, Nakkchikni, Pachittie—; *Indo-China*: Co the, Thach ho tuy—; *Malaya*: Chikkana, Chhikika, Chu tsao, E tai shih, O tai shih, Pe kong chau, Shih u sui, Yoo pak seek—; *Marathi*: Nakashikani, Narasinkani—; *Mundari*: Acuara, Acusing—; *New South Wales*: Sneezeweed—; *Persian*: Gawejahan—; *Sanskrit*: Chhikkani, Chhikkika, Ghranadukhada, Kruranasa, Kshavaka, Kshavakrita, Sanvedanapatu, Tikshna, Ugra, Ugragandha—; *Santal*: Bediachim—; *Sind*: Afkar—; *Tagalog*: Harangan—; *Urdu*: Nakachhikani—; *Victoria*: Gukwonderuk—; *Visayan*: Harangan, Pissic—.

CENTRATHERUM.

The genus consists of 15 tropical species, mostly Asiatic, with four American and one Australian.

Centratherum anthelminticum O. Ktze. (= *Vernonia anthelmintica* Willd.) is found throughout India and Ceylon, often cultivated.

The plant, roasted in a room, or powdered and thrown about the floor, is believed to expel fleas.

The juice of the leaves is given to cure phlegmatic discharges from the nostrils.

In Hindu medicine the seeds have long been esteemed as one of the principal remedies for white leprosy and other skin diseases. The drug is powdered with an equal quantity of black sesamum, and a drachm of the powder is taken in the morning with tepid water after perspiration has been induced by exercise or exposure to the sun; the diet should consist of milk and rice. In leucoderma a decoction of emblic myrobalans and catechu is given with the powdered drug. Externally the seeds are used in skin diseases in a variety of forms, such as powder, paste, oil, infusion, juice.

On the Malabar Coast an infusion of the seeds is given for coughs and against flatulency. In Travancore the bruised seeds, ground up to a paste with lime juice, are largely employed as a means of destroying lice.

In the Konkan the seeds enter into the composition of a popular antiperiodic powder. In the Punjab they are considered febrifuge; they are also given in anasarca, and used for plasters for abscesses. In Ceylon they are recommended for fever convulsions.

European doctors practising in India consider the seeds a valuable tonic, stomachic, and diuretic.

The seeds are considered as powerfully anthelmintic in South India, and are also an ingredient of a compound powder prescribed in snake bites.

The author of the *Makhzan-el-Adwiya* says that the seeds are given internally to remove phlegm and worms from the intestines, and that a poultice or plaster is used to disperse cold tumours. He concludes by stating that the drug is not often prescribed internally, as it is thought to have injurious effects, but that it is much used as a cattle medicine.

The seeds are used instead of quinine by the Mundas of Chota Nagpur. In paralysis of the legs the powdered seeds are applied externally. When the stomach of cattle swells, the powdered seeds are mixed in equal quantity with salt and soot from the fireplace. This is dissolved in water with the addition of two capsules of Spanish pepper, and given as a drink.

Wrench (1919), Caius and Mhaskar (1923) have reported unfavourably of the seeds in the treatment of hookworm infection.

There is conflict of opinions as to the value of the seeds in the expulsion of roundworms; not only in the past, but also in more recent times. Whilst Koman (1919-20) finds the seeds to possess considerable ascaricidal properties, Caius and Mhaskar (1923) report very unsatisfactory results.

The seeds contain a rather large quantity of resin. This was tried in a number of cases of helminthic infections at the Carmichael Hospital for Tropical Diseases, Calcutta. It appears to have very little effect on the ascaris. It is, however, distinctly effective in threadworms infections. In several children to whom the resin powder was administered, threadworms were expelled in the stools in large numbers and the symptoms which are often very troublesome, such as nocturnal enuresis and grinding of the teeth, were relieved.

Mhaskar and Caius have shown experimentally that the seeds are not an antidote to either snake or scorpion venom.

Arabic: Atar-i-lal, Itr-i-lal, Kamun-e-bari—; *Bengal*: Babchi, Bapchi, Bukshi, Hakuch, Kaliziri, Somraj—; *Bombay*: Kalenjiri, Kalijiri—; *Canarese*: Kadujirage, Kadujirige, Kalajirige, Sahadevi—; *Deccan*: Kalajira, Kalijiri, Karviziri—; *English*: Purple Fleabane, Wild Cumin—; *French*: Herbe aux mouches—; *Gujerati*: Kadvojiri, Kalijiri—; *Hindi*: Bakshi, Bukshi, Kalijhiri, Kaliziri, Somraj, Vapchi—; *Kumaon*: Kalijiri—; *Malayalam*: Kalajirakam, Kattasiragam, Kattujirakam, Puvankuruntala—; *Marathi*: Kalajira Kalenjiri, Kalijiri, Karalye, Ranachajire—; *Mundari*: Karigiri, Karijiri, Karijuri, Piritijudiring, Saoraj—; *Persian*: Atarilal, Itrilal—; *Porebunder*: Kalijiri—; *Punjab*: Bukoki, Kakshama, Kalazira, Kaliziri, Malwabakshi—; *Sanskrit*: Agnibija, Aranyajiraka, Avalguja, Atavijiraka, Brihanyali, Kana, Kananajiraka, Krishnaphala, Kshudrapatra, Putiphali, Sahadevi, Somaraji, Tiktajiraka, Vakushi, Vanajiraka—; *Sinhalese*: Sanninaegam, Sanninasang, Sanninavan—; *Tamil*: Katchiragam, Kattuchiragam, Neychitti, Nirnochi, Sittilai—; *Telugu*: Adavijilakatta, Garitikamma, Nelavavili, Vishakantakamulu—; *Tulu*: Kalajrdari—; *Urdu*: Janglijiri—; *Uriya*: Somraj—.

CHRYSANTHEMUM.

The genus includes 180 species, natives of the northern hemisphere.

The following are used medicinally in Europe—*C. Balsamita* Linn., *C. cinerariaefolium* Vis., *C. Leucanthemum* Linn., *C. Parthenium* Bernh., *C. vulgare* Bernh.—; in Persia—*C. Marschallii* Aschers—; in China—*C. coronarium* Linn., *C. Decaisneanum* Max., *C. indicum* Linn., *C. sinense* Sab.—; in Indo-China—*C. indicum*

Linn., *C. sinense* Sab.—; in North America—*C. cinerariaefolium* Vis., *C. Leucanthemum* Linn.

Annual ... ... 1. *C. coronarium.*
Perennial ... ... 2. *C. indicum.*

1. **Chrysanthemum coronarium** Linn. is a native of the Mediterranean region, planted in Indian gardens.

The Yunanists consider the bark a purgative useful in syphilis; they apply the leaves topically to lessen inflammation.

The people of the Deccan administer the plant in conjunction with black pepper in gonorrhoea.

Arabic: Adharyun—; *Assam*: Pithogarkah—; *Bengal*: Guldaudi—; *Bombay*: Seoti—; *Canarese*: Hale—; *Chinese*: T'ung Hao—; *Deccan*: Gulchini—; *Egypt*: Mandiliye, Qehawan—; *Gujerati*: Guldaudi—; *Hindi*: Akurkurra, Gulchini, Guldaudi—; *Ladak*: Kalzang—; *Malta*: Crown Daisy, Bambagella, Fior d'oro, Lellux, Zigland—; *Marathi*: Gulesevati, Tursiphal—; *Persian*: Guledaudi—; *Punjab*: Bagaur, Zaenil—; *Sinhalese*: Lavulugas—; *Tamil*: Shamantippu—; *Telugu*: Chamanti—; *Urdu*: Gulechini—.

2. **Chrysanthemum indicum** Linn. is a native of China and Japan, grown in Indian gardens.

The natives of the Deccan administer the plant in conjunction with black pepper in gonorrhoea.

In China the flower heads are made into tonic and sedative preparations. Infusions are frequently applied as a collyrium in eye affections.

In Malaya the flowers are used for sore eyes and to promote longevity.

In Indo-China the leaves are used as a depurant; they are prescribed in migraine. The flowers are given for sore eyes and for inflammations of the abdomen.

The flowers in the form of an infusion are used by the natives of Guam as a remedy for intermittent fevers, and are valued by women as a remedy for hysteria and monthly irregularities.

Bengal: Chandramallika—; *Bombay*: Akurkura, Chevati—; *Chinese*: Yeh chu—; *English*: False Camomile, Indian Chrysanthemum—; *French*: Pyrèthre—; *Guam*: Manzanilla—; *Hindi*: Guldaudi—; *Indo-China*: Cuc rieng vang, Gia cuc, Kien cuc am dat, Kim cuc—; *Ladak*: Kalzang—; *Marathi*: Shevati—; *Philippines*: Manzanilla, Rosa de Japón—; *Punjab*: Bagaur, Gendi—; *Tagalog*: Dolontas—; *Tamil*: Akkarakkaram—; *Telugu*: Chamunti—; *Urdu*: Guledawoodi—.

CICHORIUM.

This genus includes 8 species scattered over the temperate regions of the Old World; some occur in America as an introduction.

A. Annual ... ... 3. *C. Noëanum.*
B. Perennial
  1. Stem leaves hastate at the base ... ... 1. *C. Endivia.*
  2. Stem leaves entire ... ... 2. *C. Intybus.*

1. **Cichorium Endivia** Linn. is a native of the Mediterranean region, cultivated in India.

It is much valued by the Hakims as a resolvent and cooling medicine, and is prescribed in bilious complaints.

The root is used in dyspepsia and fever as a tonic and demulcent; the fruit as a cooling remedy for fever, headache, and jaundice.

The root is considered warm, stimulating, and febrifuge; given in 'Munjus', the diluent taken preparatory to purging; the seed is used in sherbets.

The root is officinal in Portugal.

Bengal: Kassin—; *Bombay*: Kasini—; *Dutch*: Andijire—; *Egypt*: Aburrukeyb, Endiwiya, Hendeba, Hindib, Shikuriya, Silis—; *English*: Garden Endive—; *French*: Chicorée blanche, Chicorée endive, Chicorée frisée, Endive, Escarole, Scariole, Scarole—; *German*: Endivie—; *Greek*: Radiki, Radikion—; *Hindi*: Kasini—; *Hova*: Saladingita—; *Iraq*: Hindiba—; *Italian*: Endivea, Indivia—; *Languedoc*: Enderio, Endevio, Endive—; *Mundari*: Risasalad—; *Portuguese*: Chicorea, Endivia, Escarolla—; *Roumanian*: Laptuca—; *Russian*: Laktuk—; *Spanish*: Ekarola—; *Tamil*: Kashini—; *Telugu*: Koshi—; *Turkish*: Hiddiba—.

2. **Cichorium Intybus** Linn. is indigenous to Persia, and is cultivated in Europe and India. It is a common weed over all well-cultivated land in the vicinity of water-courses and wherever there is damp clay soil in Baluchistan, Waziristan, and North-West India up to 6,000 ft.

The Mahomedan writers recognize a cultivated sweet variety and a wild bitter variety.

In Loralai the plant is used as a cure for diarrhoea and bilious attacks.

In Persia, Baluchistan, and India the root is a resolvent and cooling medicine for bilious attacks. The seeds are also considered a cooling medicine.

In Europe the root is a bitter tonic, diuretic, and laxative. A decoction of 1 ounce of the root to 1 pint of boiling water is taken freely in jaundice, liver enlargements, gout, and rheumatic complaints. In France the leaf is considered as a very good substitute for the root; it is used in the form of an infusion, and as such is a very popular laxative.

The seeds are considered carminative and cordial. A decoction is used in obstructed menstruation and for checking bilious vomiting.

The root is officinal in Portugal; the root and the leaves are given official recognition in France.

Arabic: Hindubar, Indyba—; *Baluchistan*: Zral—; *California*: Chicory, Ragged Sailor, Saccory, Wild Bachelor's Buttons—; *Catalan*: Camaroja, Mastagueres, Xicoina, Xicoines, Xicoira, Xicoria amarga—; *Dutch*: Bitterste Cichory, Cichory, Wilde Cichory—; *Egypt*: Hendeb, Shikurie—; *English*: Chicory, Succory, Wild Endive, Wild Succory—; *French*: Barbe de capucin, Bois de corde, Cheveux de paysan, Chicorée amère, Chicorée sauvage, Ecoubette, Herbe à café, Herbe amère, Inthybe—; *German*: Blausamenwirbel, Cichorie, Hindeg, Verfluchte Jungfer, Weglunge, Wegwarte, Wegweiss, Wilde Endivie, Zichorie—; *Greek*: Kichora, Kikori, Kikorion, Korla, Seris Pikris—; *Gujerati*: Kasani—; *Hamadan*: Kashni—; *Hindi*: Hinduba, Kasni—; *Italian*: Cicorea, Cicoria, Radicchio—; *Loralai*: Kashin—; *Malta*: Chicory, Cicoria, Radicchio, Cicueira—; *Pacific Coast*: Blue Daisy, Blue Dandelion, Blue Sailors, Chicory, Succory—; *Persian*: Hinduba, Kasani, Kasni—: *Polish*: Podroznik—; *Portuguese*: Almeirao, Chicorea brava—; *Provence*: Cicoureio—; *Punjab*: Gul, Hand, Kasni, Suchal—; *Roumanian*: Cicoare—; *Russian*: Tsikorie—; *Spanish*:

Achicoria, Achicoria silvestre, Achicoria amarga, Chicoria—; *Swedish*: Waegwarda—; *Tamil*: Kashini—; *Teheran*: Kashni—; *Telugu*: Kasini—; *Urdu*: Kasani—; *Uruguay*: Achicoria—; *Yemen*: Hendibe—.

3. **Cichorium Noeanum** Boiss. is found in Baluchistan whence it spreads over to Mesopotamia.

In Baluchistan the flowers are soaked in water, and the water used for sore legs and also for the stomach derangement called 'dik'.

Brahui: Kashnen, Kashni, Talka kah—.

CNICUS.

The genus numbers about 150 species found in the northern temperate regions.

C. japonicus Maxim., *C. sinensis* Gard. and Champ., *C. spicatus* Maxim. are used medicinally in China and Japan; *C. arvensis* Hoffm., *C. benedictus* Linn. in Europe; *C. arvensis* Hoffm. in the Pacific Coast States of North America.

Heads dioecious ... ... 1. *C. arvensis.*
Heads bisexual ... ... 2. *C. sinensis.*

1. **Cnicus arvensis** Hoffm. is found in Bengal and the Gangetic Plains extending from the Sunderbunds to the Punjab. It occurs in the Western Himalaya from Kashmir to Kumaon, and in Western Tibet at 11,000-13,000 ft. It is distributed to Northern Asia and westwards to the Atlantic.

The plant is emetic, tonic, diaphoretic, and reported to contain an alkaloid.

The root is astringent.

England: Creeping Field Thistle—; *Pacific Coast*: Canada Thistle—.

2. **Cnicus sinensis** Gard. and Champ. is a native of China extending to Burma and India. It occurs in marshy places on the Khasia Hills at 4,000-6,000 ft.

The stem and leaves are antiscorbutic. The root is given internally for flatulence; externally it is used for ulcers and abscesses.

Chinese: K'u Ao—.

COTULA.

The genus includes 50 cosmopolitan species found mostly in the southern hemisphere.

C. aurea Loefl. and *C. coronopifolia* Linn. are used medicinally in Europe; *C. anthemoides* Linn. and *C. villosa* DC. in South Africa.

Achenes ovate with thick narrow wings. Leaves bipinnatifid
or bipinnatisect ... ... 1. *C. anthemoides.*
Achenes oblong hardly winged. Leaves 1-2-pinnatifid ... 2. *C. aurea.*

1. **Cotula anthemoides** Linn. is found in the Gangetic Plain from Rajmahal and Sikkim westwards to the Punjab. It is distributed to China and to Africa, Northern and Southern.

The plant heated with oil is applied externally in rheumatism. The infusion is used as a wash in most diseases of the eye.

A decoction is a Xosa remedy for head and chest colds. The nostrils are sometimes filled with the crushed leaf for colds.

The Sutos use a decoction of the leaf and root as a colic remedy.

Egypt : Ribbin— ; *Hindi* : Babuna— ; *Kashmir* : Tulobe— ; *Punjab* : Babuna— ; *Suto* : Hlapi-e-nyenyane— ; *Urdu* : Babunah— ; *Xosa* : umHlonyane—.

2. **Cotula aurea** Linn. is found in the Punjab. It is spread over Persia, Syria, Malta, Algeria and Spain.

In Spain the plant, chiefly the flowers, is used as a tonic, diaphoretic, anthelmintic, antipyretic, antihysteric, and for pain in the bowels. The flower heads are officinally recognized.

Catalan : Camamilla fina— ; *Spanish* : Manzanilla fina—.

CREPIS.

The genus includes 170 species, natives mostly of Europe, Asia and North Africa.

Crepis acaulis Hook. fil. is common in the subtropical Himalaya from Jammu to Bhutan, in the Lower Gangetic Plain, Central India, Kanara and the Nilghiris. It is equally common in Burma.

Among the Mundas of Chota Nagpur the baked leaves, or the root ground and mixed with goat's milk, are taken to activate the secretion of milk in women. The root is also eaten raw in urinary complaints.

Mundari : Etete-ara, Pirieteke—.

DICHROCEPHALA.

The genus consists of 5 Asiatic and African species.

Dicrocephala latifolia DC. occurs on the Western Ghats from Bombay southwards, in the tropical and subtropical Himalaya from Simla to Sikkim at 8,000-9,000 ft., in the Khasia Hills, Cachar, Burma, and in the Malay Peninsula where it is rare. It is distributed over tropical and subtropical Asia and Africa.

The young shoots are used externally in Cambodia for the treatment of blennorrhagia in women, and for the bites and stings of insects.

Cambodia : Kbet choun thom, Kombet choun— ; *Indo-China* : Phuc linh thai—.

DICOMA.

The genus numbers 30 species inhabiting Africa, Madagascar, and tropical Asia.

D. tomentosa Cass. is used medicinally in West Africa; *D. anomala* Sond., *D. capensis* Less., *D. speciosa* DC., *D. Zeyheri* Sond. are used in South Africa.

Dicoma tomentosa Cass. is spread over India from the North-West and the Punjab to Sind, Gujerat, the Deccan, the South Mahrata Country, the Carnatic, Mysore, Coimbatore, and the Nilghiris. It is fairly common in tropical Africa.

The herb is strongly bitter, and is used in the neighbourhood of Belgaum as a febrifuge, especially in the febrile attacks to which women are subject after childbirth.

In Hausa and Nigeria the herb is used as a local application to putrescent wounds.

Belgaum: Navananjichapala—; *Gujerati*: Gholoharnacharo—; *Hausa*: Dauda, Farin dayi, Kwardauda, Surandu—; *Katagum*: Dowda—; *Rajputana*: Vajradanti—.

DORONICUM.

The genus consists of 25 species, inhabitants of the northern temperate regions of the Old World.

D. austriacum Jacq., *D. Columnae* Tenore, *D. Pardalianches* Linn., *D. plantagineum* Linn. have been used medicinally in Europe.

A. Achenes all pappose. Heads 1-2 ... ... 2. *D. Hookeri.*

B. Achenes of the ray epappose, of the disk pappose.
  1. Herbaceous, 2-4 ft. high. Heads few or numerous ... 3. *D. Roylei.*
  2. Stout herb, 1-1½ ft. high. Heads 1-2 ... ... 1. *D. Falconeri.*

1. **Doronicum Falconeri** Clarke occurs in Kashmir at an altitude of 13,000 ft., and in the Karakoram Range at 14,000 ft.

The root is said to be useful in nervous depression.

2. **Doronicum Hookeri** Hook. fil. is found in the Sikkim Himalaya at Lachen and Tungu between 12,000 and 14,000 ft.

The root is an aromatic tonic.

3. **Doronicum Roylei** DC. is found in Kashmir and Garhwal at 10,000 ft.

The root is used to prevent giddiness on ascending heights.

ECHINOPS.

The genus includes 82 species, mostly Mediterranean distributed over Southern and Eastern Europe, tropical and North Africa, and Asia to Japan and Siberia.

E. dahuricus Fisch. is used medicinally in China; *E. longifolius* A. Rich. in Nigeria.

Turkish Manna is obtained from *E. persicus* Stev.

Three alkaloids—echinopseine, echinopsine, and B-echinopsine—have been insolated from the seeds of *E. ritro* Linn.

Echinops echinatus Roxb. occurs more or less throughout India and Afghanistan.

The plant is used by both Ayurvedists and Yunanists.

At Hesargai the roots are pounded and mixed with Acacia gum and applied to the hair to destroy lice; also the powdered roots are applied to wounds in cattle to destroy maggots.

Arabic: Ashtarkhar—; *Gujerati*: Shuliyo, Utkanto, Utkato—; *Hindi*: Gokhru, Utakanta, Utakatira—; *Marathi*: Kadechubak, Utanti, Utati, Utkatara—; *Ormara*: Gurgaj—; *Persian*: Astarkhar—; *Pushtu*: Chingamwali—; *Sanṣkrit*: Kantalu, Kantaphala, Karamadana, Mukhadantarujapaha, Raktapushpa, Shrigala, Shunakashana, Tikshnagra, Ushtrakanta, Utati, Utkantaka, Utkatotkata, Vrittaguchha—; *Urdu*: Untkatara—; *Yemen*: Jirdama—.

ECLIPTA.

The genus consists of 4 species, South American, Australian, and cosmopolitan.

Eclipta alba Hassk. is cosmopolitan in warm climates. It is found throughout India, ascending to 6,000 ft. in the Himalaya and other mountains.

The plant is an Ayurveda and Yunani medicine.

It is principally used as a tonic and deobstruent in hepatic and splenic enlargements, and in various chronic skin diseases. There is a popular opinion that the herb taken internally and applied externally will turn the hair black.

The fresh plant is applied with sesamum oil in elephantiasis, and the expressed juice is taken internally in affections of the liver and dropsy. When used in large doses, it acts as an emetic. It is also considered cooling. It is anodyne and absorbent, and relieves headache when applied with a little oil.

The plant is considered an astringent in China, and is used for checking haemorrhages and fluxes and strengthening the gums. The plant is rubbed on the gums for toothache, acting as a counter-irritant.

The plant is much used as a cure for asthma and bronchitis in Indo-China. In Ceylon it is used to purify the blood.

In La Reunion the plant is considered as pectoral and anti-asthmatic. The decoction is prescribed externally for skin diseases and elephantiasis.

In Bombay, the natives use the juice in combination with aromatics, as a tonic and deobstruent, and give two drops of it with eight drops of honey to new-born children, suffering from catarrh. In the Gujrat district of the Punjab, it is used externally for ulcers, and an antiseptic for wounds in cattle.

The root is given to relieve the scalding of urine. In Chota Nagpur it is applied in conjunctivitis and galled necks in cattle.

In Assam the leaves are reputed to cure sores when applied to them.

The juice of the leaves is generally given in one teaspoonful doses in jaundice and fevers. It is rubbed fresh on the shaven scalp for the purpose of promoting the growth of the hair. The pounded leaves are prescribed in haemorrhage.

In Gold Coast the leaves are ground and mixed with cold water; this mixture is then drunk to cure constipation.

The leaves are used in Brazil as a remedy for diarrhoea and as a black stain for the hair.

In scorpion sting the leaves are rubbed on the part affected as well as inhaled. In practice the leaves are first rubbed from above the inflamed part down to the sting; they are then made into a paste and applied as a poultice.

Koman, summing up his work with this plant, says: 'There are two varieties of the plant—the yellow flowered and the white flowered—the former variety has thicker leaves which are extensively used in catarrhal jaundice. The fresh leaves are well washed, ground with a few pepper corns, and a lump of the size of a lime is administered early in the morning in sour curd or buttermilk. I have found this drug very useful in curing the disease when so administered for five or six days. Occasionally a purgative may be required to aid the action of the drug. In its action, it resembles podophyllin and taraxacum. It may be administered in the form of a succus.'

Arabic: Kadim-el-bint, Tolak—; *Ashanti*: Ntum—; *Baluchi*: Murida—; *Bengal*: Kesari, Keshori, Kesuti, Keysuria—; *Brahui*: Bikgur—; *Canarese*: Garagadasappu, Kadiggagaraga—; *Ceylon*: Kaikechi, Kaivichi illai, Karichalankanni, Karippan—; *Chinese*: Han Lien Ts'ao, Li Ch'ang, Me Teou T'sao, Pa Ko Ts'ao—; *Egypt*: Sa'de—; *Gujerati*: Bhangra, Dodhak, Kalobhangro, Kaluganthi—; *Hasada*: Pirikesari—; *Hindi*: Babri, Bengraya, Bhangra, Mochkand, Mochrand—; *Ilocano*: Tintatinta—; *Indo-China*: Co muc, Lien tao, Nho noi, Phong trang, Phong truong—; *Iraq*: 'Arundis—; *Kolami*: Hatukesari—; *Lagos*: Abikolo—; *Mundari*: Benggaraj, Benggraj, Bhenggaraj, Bhenggraj, Huringsarsiranu, Sarsingranu—; *Rajputana*: Jal bangra—; *Sadani*: Bengaria—; *Sanskrit*: Ajagara, Angaraka, Bhekaraja, Bhringa, Bhringaraja, Bhringasodara, Bhringavha, Ekaraja, Karanjaka, Kesharaja, Kesharanjana, Keshya, Kuntalavardhana, Mahabhringa, Mahanila, Markara, Markava, Nagamara, Nilabhringaraja, Nilapushpa, Pankajata, Pararu, Patanga, Pitripriya, Rangaka, Shyamala, Sunilaka—; *Santal*: Lalkesari—; *Sind*: Tik—; *Sinhalese*: Kikirindi, Kikirindiha—; *Tagalog*: Higuismanoc—; *Tamil*: Kaikeshi, Kaivishiilai, Karishalanganni—; *Telugu*: Galagara, Guntagalijeru, Guntakalaagara—; *Urdu*: Bhangra—; *Uriya*: Kesarda—; *Uruguay*: Yerba de la oveja—; *Yoruba*: Abikolo, Arojoku—.

(*To be continued*).

NOTES ON BUTTERFLIES OF THE SHAN STATES.

BY

CAPT. W. C. CARROTT.

(*Continued from page* 665 *of vol.* xl).

Since writing the list of butterflies found in the Shan States I would like to mention one or two observations made and not mentioned in the first list.

During April of this year I caught a damaged specimen of *Chilasa slateri marginata.* So this butterfly does appear in the Shan States. I caught the above specimen at Maymyo, 3,500 ft.

Byasa aidoneus. A couple of males of this butterfly was caught by me during May of this year, so evidently it is double brooded.

In my previous list I mentioned that *Papilio noblei* was reported to be plentiful in the Myitkyina District. I have visited this district twice this year, end of March and end of June. During my first visit I caught one male, and the second visit I was fortunate in getting half a dozen. It flies along with *helenus helenus* and *chaon chaon* and is difficult to differentiate when on the wing. Like others of this family it settles on the damp patches of ground. No females were caught or seen.

One other butterfly caught in March in this district and not recorded as being found in Burma was *Elymnias pealii.* Evans mentions it as being found in Assam.

While on this tour end of March I came across *Appias nero galba* gathered on the sand near a stream and I never saw so many butterflies together before. Truly there were hundreds of thousands, chiefly wet season form and only a few of the dry season form. Why the wet season form should be out and in the majority instead of the dry season form I am at a loss to understand. It was impossible to collect one at a time as each sweep of the net caught at least fifty. All males of course.

Another interesting capture while on this tour was a *Penthema* which differs from *lisarda lisarda* or *darlisa.* It favours *darlisa* but does not have sub-marginal spots shaped like arrow heads. The colour of the spots are not so blue and some other markings are different. It would appear to be an intermediate race. I caught two males of this butterfly.

NYMPHALIDÆ.

CHARAXES

polyxena hiera. Fd. Fairly common all over the Shan States. Males are filth eaters and are to be found feeding on excreta of wild animals. The varieties *corax, hipponax* and *pleistoanax* are also found along with *hierax.*

marmax. Wd. I have seen this only in the South Shan States and is very rare there.

fabius sulphureus. Roth. Not seen in the North but fairly plentiful at Lebin, 2,000 ft. in the South.

ERIBŒA

schreiberi assamensis. Roth. Caught two males of this very rare butterfly at Maymyo, 3,500 ft. One on October last year and the other about ten years ago.

athamas athamas. Dr. Very common all over the country.

arja. Fd. Also very common.

moori sandakanus. Fruh. Very rare indeed. Not seen in the Shan States, but a damaged specimen was given me and caught near Pyinmana probably at the foot of the Shan States Hills.

dolon magniplaga. Fruh. Found at Kalaw in the South. None seen in the North. A friend of mine at Kalaw found three chrysalises in his garden and was successful in breeding two of them, a male and a female.

dolon grandis. Roth. Males fairly plentiful at Kalaw in the South. I used to catch quite a number while feeding on the bed of a stream near the Railway Station.

narcœa lissainei. Tyt. Very rare indeed. I have seen only one and failed to net it.

eudamippus nigrobasalis. Lathy. A few caught in different parts of the States.

delphis. Db. Not seen in the Shan States proper, but they are fairly plentiful on the Karen Hills in the Toungoo District.

PROTHŒ

calydonia belisama. Crow. Not seen in the Shan States proper, but a couple of females were caught by me at Pathechaung at the foot of the Karen Hills, end of April of this year.

franckii angelica. But. Not seen in the Shan States. A pair caught at Pathechaung same time as above.

APATURA

cooperi. Tyt. I have caught half a dozen pairs at Maymyo which I believe is the only place in which it is to be found.

ulupi kalaurica. Tyt. This should be spelt *kalawiea* as it was first found by my friend Mr. Dingavan at Kalaw and from whom General Tytler got his specimens. I have not seen it in the North and it appears to be very rare even in the South.

dingavani. This new butterfly has not yet been officially recorded, but I understand Mr. Dingavan of Kalaw has sent specimens to General Evans for naming. It is somewhat like *ulupi florenciae*. Strange to say this new butterfly is only found in the garden of Mr. Dingavan at Kalaw. The country round about has been searched but no trace of it can be found. About six pairs have so far been caught, one pair of which is in my collection.

ambica ambica. Koll. Not at all common in the Shan States. I have seen only one at Maymyo and one other at Kalaw. It is more common on the plains in the North of Burma.

parisatis parisatis. Wd. I caught a number of males at Yinmabin 1,200 ft. in the Southern Shan States. I have not seen any females. It does not appear to fly at higher altitudes.

HERONA

marathus marathus. Db. Fairly plentiful at Maymyo in the North, but not seen elsewhere.

SEPHISA

chandra. M. Males very common in the Shan States. One female of the typical form caught by me at Maymyo, and one female of the variety *chandrana* in my garden. I have not seen the variety *albina.*

EURIPUS

halitherses. Dob. and Hew. Two males in my collection. No females seen.

DIAGORA

persimilis persimilis. Wd. Rare in the Shan States. One male caught at Maymyo this year, and one male at Kalaw.

HESTINA

nama. Db. Fairly common in the South but rare in the North.

CALINAGA

buddha sudassana. Melvill. I generally manage to collect two or three males every year, end of March or beginning of April. This year I was more fortunate and caught two females in coitu.

PENTHEMA

darlisa. M. Caught a few males in the Momeik State, just above Mogok Ruby Mines. This year I caught two males of the variety mentioned at the beginning of this list.

DICHORRAGIA

A few caught in both North and South.

STIBOCHIONA

Rare and only one seen which I could not net.

EUTHALIA

cocytus satrapaces. Hew. Caught a number of these at the foot of the Karen Hills, but not seen in the Shan States proper.

lepidea sthavara. Fruh. Common at Maymyo in the North.

julii sedeva. M. Plentiful all over the Shan States.

jahnu jahnu. M. Fairly plentiful.

anosia anosia. M. Rare. I have caught about six in the course of 15 years.

telchinia. Men. Very rare. Only seen one and that many years ago.

mahadeva binghami. De N. Caught one male this year at the foot of the Karen Hills, end of April. I have not seen it in the Shan States proper.

merta eriphyle. De N. Only one caught by me.

garuda garuda. M. Common all over the country.

jama verena. Fruh. Rare. Only one male caught at Maymyo.

phemius. Db. Rare in the Shan States. A pair caught by me at Maymyo during 1938.

lubentina. indica Fruh. Not too plentiful. I caught a few in the North Hsenwl State a few years ago. An occasional one at Maymyo in April.

nara shania. Ev. This used to be plentiful at Kalaw, but it is now scarce and very seldom seen.

sahadeva narayana. GrS. and Kir. Not rare, and I manage to collect a few good specimens every year at Maymyo.

pratti cooperi. Tyt. Very rare, and I have only managed to net one during my many years residence in Maymyo.

patala taooana. M. Fairly rare, but odd ones can be caught both at Maymyo and Kalaw.

evelina eve'ina. Stoll. Rare. Only two in my collection; both caught at Maymyo.

ADOLIAS

cyanipardus. But. Rare. One male in my collection caught at Kalaw.

dirtea jadeitina. Fruh. Fairly common at altitudes of about 2,000 ft.

PARTHENOS

sylvia gambrisius. F. Common all over the Shan States.

LEBADEA

martha attenuata. Very common at lower altitudes.

NEUROSIGMA

doubledayi nonius. De N. I have caught a few in Maymyo as well as Kalaw. I notice Evans records this as from Karens and Dawnas. However the Karens should be placed geographically in the Shan States, especially from an entomological point of view.

LIMENITIS

daraxa. Dob. and Hew. I have caught a few males at Maymyo, but to date have not been able to secure a female. It occurs also in the South.

dudu. Wd. Very rare, and I have only been able to collect a pair during my many years of collecting.

procris procris. Cr. Very common all over the Shan States.

PANTOPORIA

sulpitia adamsoni. M. I have caught a few of these at Maymyo.

nefte inara. Db. Not too plentiful. Two or three specimens caught every year.

cama. M. Same remarks as the above.

selenophora selenophora. Koll. Very common indeed, especially males which delight in gathering on moisture on the roads.

zeroca. M. Rather rare in the Shan States.

opalina orientalis. Eb. A few of these can be caught during the rains at Maymyo.

ranga ranga. M. Not too rare. I have caught a number of good specimens during my residence in the Shan States.

larymna siamensis. Fruh. Rare, but I have succeeded in collecting a few good specimens at Maymyo.

asura asura. M. Not at all rare.

perius. L. Very common.

NEPTIS

columella ophiana. M. Common.

jumbah jumbah. M. Common.

magadha khasiana. M. Very rare. Only one male caught by me.

hylas astola. M. Very common.

hylas adara. M. Very common.

soma soma. M. Rare, only one male in my collection.

nandina susruta. M. Not too plentiful.

yerburyi shania. Ev. Fairly plentiful at Maymyo.

sankara quilta. Sw. Rare and very seldom seen.

harita. M. Also rare, only one male caught by me.

anjana nashona. Sw. Rare.

ananta ochracea. Ev. Rare, found at Kalaw in the South.

manasa. M. Not very rare, but very local. I have secured a number from Kalaw; and if one knows their feeding plant it is not difficult to get a number.

dindinga assamica. M. Very rare. A couple of males only in my collection

hordonia hordonia. Stoll. Common all over the Shan States.

CYRESTIS

periander periander. F. I have only seen this very fragile butterfly at the bottom of the Goteik Gorge in the North.

cocles cocles. F. As above.

thyodamas thyodamas. Bdv. Very common.

CHERSONESIA

risa. Dob. and Hew. Fairly plentiful in all of Shan States.

rahria rahrioides. M. Not so plentiful as the above, but quite a number can be collected in one season.

PSEUDERGOLIS

wedha. Koll. Very common at low altitudes but rare at higher elevations.

HYPOLIMNAS

misippus. L. Very rare in the Shan States. Common in the plains.
bolina. L. Fairly common all over the States.

YOMA

sabina vasuki. Doh. Males are very common around Maymyo as they can be found in swarms feeding on cement bridges.

RHINOPALPA

polynice birmana. Fruh. I have not come across this in the hills, but secured a couple of males at the foot of the Karen Hills, Toungoo District.

DOLESCHALLIA

bisaltide indica. M. Only found at low altitudes. One male only in my collection.

KALLIMA

inachus limborgi. M. Fairly common all over the Shan States.

PRECIS

hierta magna. Ev. Very common.

orithya ocyale. Hub. Common.

lemonias lemonias. L. Very common.

almana almana. L. Very common.

atlites. L. Common.

iphita iphita. Cr. Extremely common.

VANESSA

cardui. L. Rare in the North. Odd ones can be picked up at Kalaw in the South.

indica indica. Herbst. Also rare in the North; but fairly plentiful in the South, Kalaw to Taungyi.

canace canace. L. Common all over the Shan States.

SYMBRENTHIA

hippoclus khasiana. M. Common.

hypselis cotanda. Rare in the Shan States. I have only collected three of these in and around Maymyo. Odd ones have been found at the foot of the hills in the South.

ARGYNNIS

hyperbius hyperbius. L. Very common at altitudes of 3,000 ft. and over. They feed and breed on violets in my garden at Maymyo.

childreni childreni. Gray. Rare. Only found this at Kalaw. Not seen in the North.

CUPHA

erymanthis lotis. Sulz. One of the commonest butterflies in Maymyo.

ATELLA

phalanta. Drury. Very common indeed.

alcippe burmana. Ev. Very rare at high altitudes. Very seldom seen at above 1,000 ft.

ISSORIA

sinha sinha. Koll. Very common all over the country.

CYNTHIA

erota erota. F. Common at low altitudes. Fairly scarce in the hills.

CIRROCHROA

fasciata. Fd. I have only seen this at the foot of the Karen Hills near Taungoo.

neris olivacea. De N. Rare in the hills but fairly plentiful at low elevations.

tyche mithila. M. Also rare in the hills but common on the plains.

CETHOSIA

biblis tisamena. Fruh. Fairly common.

cyane. Drury. Not common.

ERGOLIS

ariadne pallidior. Fruh. Common all over the Shan States.

merione assama. Ev. Also very plentiful.

LARINGA

horsfieldii glaucescens. De N. I used to consider this very rare, and purchased a pair for my collection. The following year I secured half a dozen pairs at Maymyo. It is fairly common at Nanpandet at the foot of the South Shan State Hills.

PAREBA

vesta sordice. Fruh. Common both at Maymyo and Kalaw. Can be collected by the dozen feeding on young paddy plants.

ERYCINIDÆ.

LIBYTHEA

lepita lepita. M. Fairly common.

myrrha sanguinalis. Fruh. Common.

narina rohini. Mar. Very rare.

ZEMEROS

flegyas indicus. Fruh. Very common indeed.

DODONA

eugenes venox. Fruh. Very rare in the Shan States.

egeon. Db. Rare, but odd specimens can be found every year.

ouida ouida. M. Same as above.

henrici longicaudata. De N. Very rare. Only one male in my collection.

henrici deodata. Hew. A few specimens collected by me at Maymyo.

ABISARA

fylla. Db. Very common.

neophron neophron. Hewt. Fairly plentiful all over.

chela kalawna. Ev. Very rare.

echerius angulata. M. Very common.

kausambi paionea. Fruh. Fairly rare.

TAXILA

thuisto sawaja. Fruh. I have only found this at the foot of the Karen Hills.

haquinus fasciata. M. Found both in the North and South.

(*To be continued*).

MISCELLANEOUS NOTES

I.—BEHAVIOUR OF MONKEYS WHEN ATTACKED.

The extraordinary habit of monkeys leaving trees when attacked by dogs referred to by Mr. Dunbar Brander on p. 165 of vol. xli is common also in the case of the Nilgiri Black Langur on these hills, and a good account of this curious trait will be found on p. 185 of *Game* by 'Hawkeye' published in 1876; no explanation is however offered for such peculiar behaviour.

That wild dogs profit by this failing is evident from the fact that I have on more than one occasion in the Kundahs found black monkey fur in wild dog droppings.

E. G. PHYTHIAN-ADAMS,
Major.

KALHATTI,
NILGIRIS.
September 10, 1939.

II.—EFFECTS OF MAULING BY TIGER.

Just after reading Mr. H. A. Fooks' interesting note on the above subject in the August number of our *Journal* I was reading Dr. Haliday Sutherland's latest book—*Hebridean Journey* in which he tells the following story about a man he met at an inn at Pollachar in the Outer Hebrides (p. 164).

'Outside the inn I met a man who had lost an arm by being mauled by a tiger when shooting in India. Having written an excellent book about tigers, he was trout fishing at Pollachar before returning to India in order to make a film about tigers. I asked him if he had felt pain when the tiger was mauling his arm.'

'Not the slightest pain,' said he.

'That's very interesting, because Livingstone had the same experience when being mauled by a lion.'

'The only pain I felt was when my friend in trying to shoot the tiger missed, and like a damn fool put the bullet through my foot. That stung a bit.'

The above exactly bears out Mr. Fooks' experience.

W. H. WORKMAN.

LISMORE,
WINDSOR,
BELFAST,

III.—A BATTLE ROYAL BETWEEN TIGERS AND AN ELEPHANT.

While Hitler and Stalin were carrying out a cruel and ruthless attack on Poland, two other tigers carried out an equally cruel and ruthless attack in another part of the world. The account below of a jungle battle to the death was given to me by entirely reliable eye- and ear-witnesses, and in its main details is very well authenticated.

The Sarda river, one of the major rivers of the Himalayas, where it debouches from the hills, spreads out into a mile-wide bed of boulders and sand, dotted with islands of *shisham* trees and coarse grasses. On the right high bank, sixty or seventy feet above the river, is the small townlet of Tanakpur, with a railway terminus, a bazaar, and several bungalows situated on the bluff, looking across the wide river bed to the wild forest clad foot-hills of Nepal. In the cold weather Tanakpur is alive and populated with hill people. Forest contractors are busy exporting timber from the extensive forests, and there is a stream of cross traffic to and from Nepal. In the rains, it is almost deserted. Malaria then drives away the hill people, and the flooded river cuts off all communication with Nepal.

Late one evening in the last week of September, three men were fishing with nets in the waters of the Sarda, two or three furlongs from the bungalows on the bluff, when suddenly two tigers and a half-grown cub emerged from one of the grassy islands close by. The men shouted and yelled and the tigers moved off across the dry bare bed of the river towards the forest on the right bank, a quarter of a mile away up stream from the bluff. Simultaneously from this forest the men heard the trumpeting of a wild elephant. Shortly afterwards the fishermen, and the few dozen inhabitants of the bazaar, heard the nerve-shattering roar of a charging tiger, and the fishermen saw a big male tusker elephant come out into the open river bed, being attacked by the two tigers. For three hours the battle between the elephant and the tigers raged up and down the river bed, below the high bluff, in full view, in the moonlight, of the bungalows on the cliff. Would I had been there to see and hear ! The bazaar inhabitants were so terrified at the appalling noise and infuriated roars of the tigers so close at hand, that they barricaded themselves in their houses and no one, except the petrified fishermen who were cut off, saw this awe-inspiring and unique spectacle. About 11 p.m. the noise died down, and next morning the tigers had departed, but the dead elephant was lying at the foot of the bluff, within a stone's throw of a bungalow.

The marks on the unfortunate elephant were very instructive. The trunk was quite untouched and so was the face except deep scratches around the eyes, and *both eyes had been clawed out.* There were terrible bites and scratches on the top of the head and neck, back and rump, and finally the throat had been bitten and torn open—evidently the *coup de grâce.*

These are the facts as told to me by the eye-witnesses and by the *tahsil* officer who heard the battle and who had the job of getting rid of the body of the elephant. From them we can deduce the probable—or at least possible—course of events.

It is inconceivable that the tigers made a senseless and unprovoked attack on a full-grown tusker elephant, and equally inconceivable that the elephant started the fight. (He was neither 'musth' nor a rogue). It is probable that the tiger cub was the cause of the trouble. He may have blundered into the elephant or gone sniffing around in curiosity and received a kick or a blow for his trouble, causing him to yelp. This would at once raise the maternal fury of the tigress, and the tiger would come to the help of his mate.

The wounds on the elephant give an indication of the tactics of the tigers. It is clear that no frontal attack was attempted, or the trunk and face of the elephant must have been mauled. Probably one tiger threatened or demonstrated in front, enabling the other tiger to leap on the back (an easy leap for a tiger) and start biting and scratching. It was probably shaken off several times, but again returned to the attack. At some stage of the fight, one of the tigers must have managed to jump or crawl on to the top of the head and from that position to have clawed out the eyes, perhaps deliberately, for it seems a natural instinct of the cat tribe to go for the eyes. One can imagine the poor blind elephant, tortured with the fiendish laceration of its back, stumbling along in agony over the boulders and rough ground, falling ultimately over some low bank and exposing its throat to a hellish mauling from the other tiger, and dying from loss of blood or severance of its wind-pipe. Truly the tigers took a terrible revenge for any possible injury to their cub.

No measurements of the elephant were taken. The tusks were small but old and worn, about 32 inches long excluding a foot or more embedded and 14 inches girth at the base, and the two tusks together weighed 122 lbs.

Although I have heard of elephant calves being occasionally killed by tiger, I have never before heard or read of a fight to a finish between tigers and a full-grown bull elephant. That it should have taken place before eye-witnesses, and within ear-shot of many more, is a piece of remarkable luck.

LUCKNOW, E. A. SMYTHIES,
December 22, 1939. C.I.E., I.F.S.

[Encounters between tigers and elephants occasionally occur. Mr. Q. G. Corbett writing in our *Journal* (Vol. vii, p. 119) gives three instances. Two deal with attacks on female elephants: the objective in one being a calf which was killed despite the mother's attempts at rescue. The third records an attack on a big tusker, which was so dreadfully mauled along the whole length of its back, that it died a few days after. As is usual with big animals which cannot be easily mastered, the tigers' attack in the three instances reported by Corbett was not frontal, but directed from the rear: the tiger biting into the hind quarters, back and shoulders. The tigers' way with elephant calves is to hamstring them or attempt to do so. Mr. Milroy (*Jour., B.N.H.S.,* Vol. xxxii, p. 370) in two seasons shooting in North Cachar came upon 4 or 5 elephant calves that had been attacked in this way. In the instance reported in our *Journal* by Mr. J. K. Swaine (Vol. xxxvi, p. 983) the tiger's attack on a cow elephant was directed to the belly and under parts. This change from the usual method was probably an adaptation to circumstances. The tiger is a versatile killer and follows no stereotyped method in his killing. The cow elephant was lying down, and Mr. Swaine concludes that the tiger attacked her as she lay probably clinging on with teeth and claws tearing away the flesh by its weight as the elephant got up. She appeared in camp the next morning with a huge wound stretching from her right foreleg to well under her belly, the torn flesh hanging almost to the ground.—EDS.]

IV.—A LARGE PANTHER.

I think it will interest you to know that recently on March 23, 1939 in one of my jungles in Central India I shot a panther which measured between pegs 8 feet 6 inches. The panther was measured within an hour of its being shot. The skin of the panther was cured by Messrs. Van Ingen & Van Ingen, Taxidermists of Mysore (India). The skin now measures 8 feet 10½ inches. I may mention here that the skin was not unduly stretched in the process of its being cured.

YASHODHAR SINGH,
RAJ-KUNWAR.

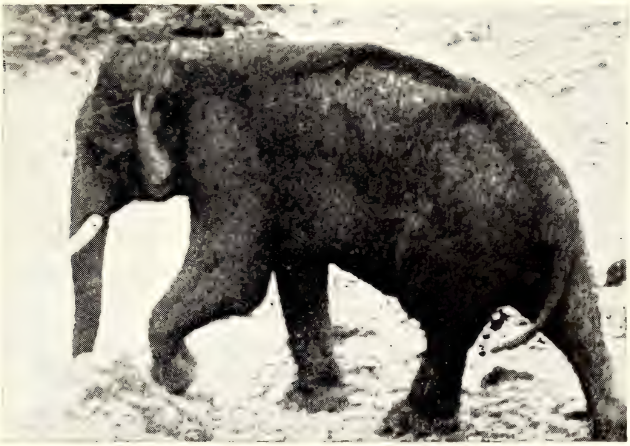
PALACE,
KHILCHIPUR,
(Central India).
October, 1939.

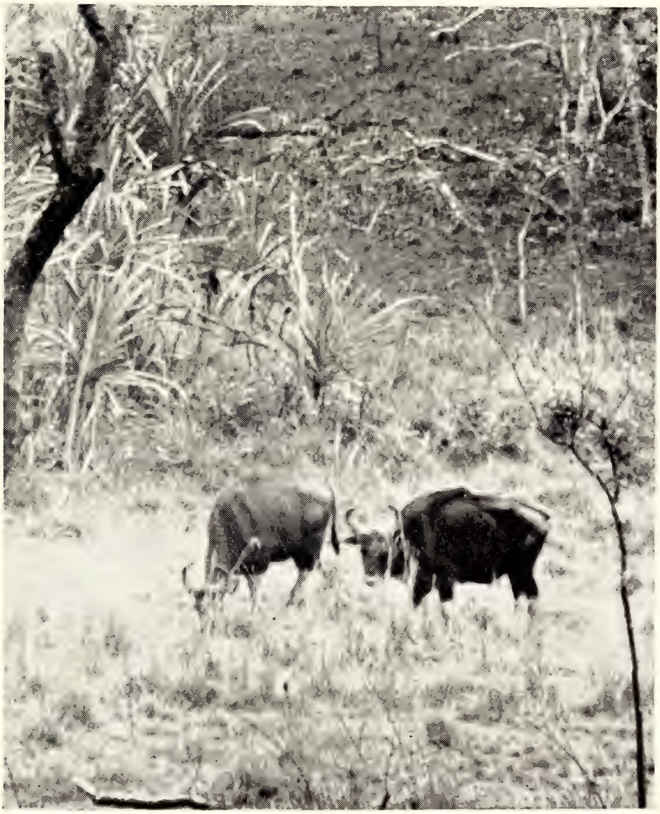
V.—BEHAVIOUR OF GAUR AND ELEPHANT.

(*With a plate*).

I have read with interest Mr. Mustill's note on the behaviour of gaur on page 731 of the May, 1939 issue.

I have had further experience since my contribution of September 1938. Using a Cine Kodak '8' and an old Kodak '3A' Camera (in use for the last 20 years) I have been able to take the accompanying photos of both bison and elephant at under 30 yards, and my previous experience as regards bison is fully borne out. As with Mr. Mustill's experience, I found no difficulty on two occasions in letting a whole herd of bison graze up to me,





Photos by *Major H. J. Rossel.*

Bison and Elephant taken within 30 yards distance.

My tracker on one occasion actually counted 40, and by the time I had succeeded in reversing the Ciné film behind a totally inadequate tree, the herd was grazing on each flank within 20 yards. They were not in the least suspicious until, having finished my film, I deliberately sent them off for fear of being run over by accident should they get my wind on moving behind me.

The photograph of the elephant shows a good tusker in his prime, which Major Phythian Adams and I succeeded after some effort, in working out of tree jungle into a fairly good light about 9 a.m. I managed to take 50 feet of cine film within 30 yards before the tusker made off into the river bed amidst dense 'lantana' growth, which was too thick (and the light too bad) for further efforts.

Both photos were taken at the northern foot of the Nilgiris. I was able to obtain a riding elephant for a few days to try for cine pictures of Chital, (the unburnt grass being 5 feet high) and the dislike of most animals, particularly pig, and to a somewhat lesser extent chital, to the near approach of an elephant was extremely noticeable—sambhur were much more tolerant.

There are many elephants in these forests, and the behaviour of other animals generally, appears an interesting commentary on the disposition of solitary elephants towards jungle life, apart from man.

It was noticeable that most animals did not dash away, as they would have on smelling or seeing man, but (for example chital) slipped quietly away in the long grass with tails down and no warning cries. This may be a suitable subject for discussion.

Practically all shooting in South India is done on foot.

H. J. ROSSEL,
Major.

25 Warwick Row,
Meerut.
October 2, 1939.

VI.—ON THE DISTINCTION BETWEEN INDIAN AND MALAYAN GAUR.

(*With a plate*).

In the Honorary Secretary's report for the year 1938, Mammals, it is indicated that Lydekker differentiates between the Malayan Gaur and the Indian Gaur by the smaller development of the cranial ridge in the former as opposed to the marked development in the latter, and to some differences in colour and markings and the presence of a dewlap. Mr. Theodore Hubback disposes of this last suggestion. I therefore think it to be of general interest if you would publish the enclosed 4 photos which I venture to suggest completely dispose of the first theory. These four bulls were all shot within a radius of 10 miles in Darrang, Assam and clearly show a marked difference in cranial development although the horns may be said to be of equal calibre.

Whilst on the subject of Bison, I should be greatly interested to hear if any further light has been shed on the vexed question of whether it has been established that there is a wild species of *Bos frontalis.* Any Assamese or Mikir Shikari will glibly talk of *Muh,* (buffaloe) Mithan and *Gurov,* (cow) Mithan, but although I have seen many mithan I have never succeeded in establishing any differences. I know many well-known and reliable Europeans who believe in the two wild species, but is there yet any scientific proof in the matter? I may say, in case it is suggested that my photos represent *Bos frontalis* and *Bos gaurus,* that all these animals were large black, almost hairless bulls none of which on account of size alone could be described as *Gurov* (cow) Mithan, but all, from the Assamese standard were Muh Mithan.

R. M. PIZEY,
Hon. Forest Officer.

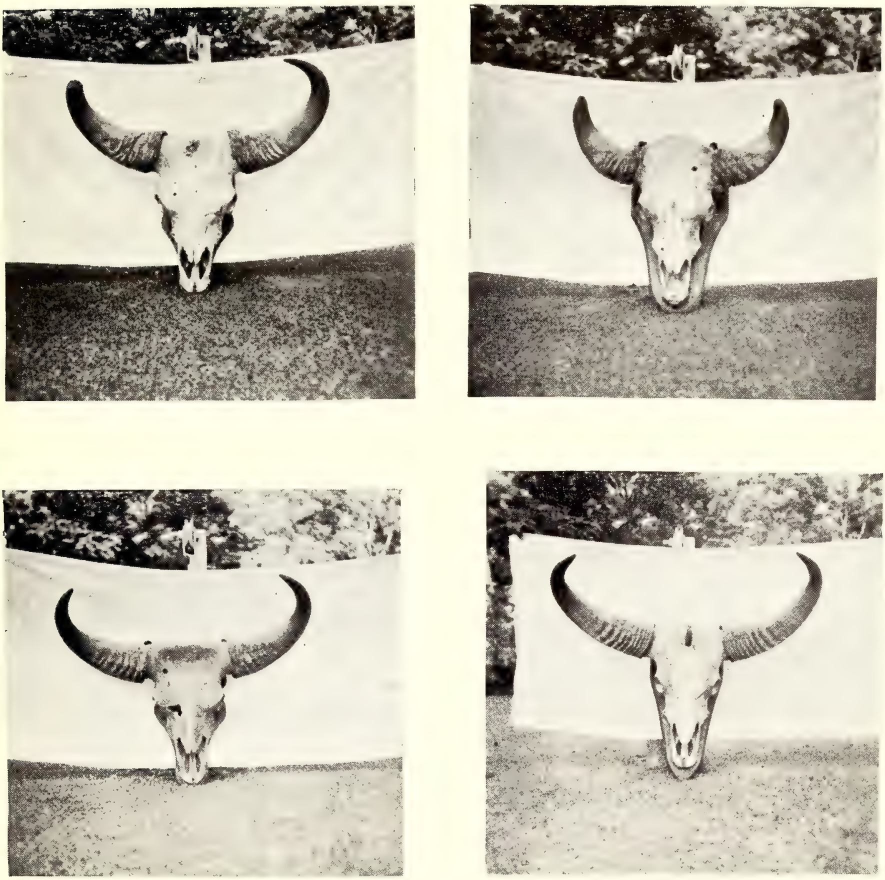
MONABARIE,
MIJIKAJAN, P.O.,
ASSAM.
September 22, 1939.

[Lydekker in his Catalogue of Ungulates—Mammals issued by the British Museum recognises three local races of the Gaur. The distribution of the typical race *Bos gaurus gaurus* is given as the Peninsula of India including Nepal, Bhutan and Assam. The second race *Bos gaurus readi* is given as inhabiting the hill forests of Burma and Tenasserim, while the third race *Bos gaurus hubbacki* is assigned to the Malay Peninsula.

The Indian and Burmese races are said to be distinguished from the Malay race by the presence of a forwardly inclined and prominent ridge between the horns, which gives the forehead a concave outline. This however is a character which may be absent in both Indian or Burmese Gaur.

Stuart Baker writing of the Gaur in Assam (*Journ. B.N.H.S.*, Vol. xv, p. 227) says that the majority of heads have a concave forehead, but that many have it only very slightly so and some not at all. He publishes a number of outline drawings in which he illustrates this variable character. All that can be said for this point of distinction betwen the Indo-Burmese and the Malay races is that while it may be applicable in general, it is not an absolute point of distinction as the concavity of the forehead may be very slight or entirely absent in many gaurs found within the Indo-Burmese region.

The Mithun, it is now established, is nothing more than a hybrid gaur. It is the result of crossbreeding between wild Gaur and domestic cattle. In Assam where inter-crossing between Gaur and Mithun still takes place, Mithun still closely resemble Gaur. In fact, there is more or less a gradual transition between the



Skulls of 4 Gaur [*Bos* (*Bibos*) *gaurus*] shot within a radius of 10 miles in Darrang, Assam. Note the marked variation in the development of the cranial ridge.

characters of the two animals. As shown by Mr. T. R. Livessey (*Journ. B.N.H.S.*, Vol. xxxv, p. 199) in the Chin Hills, where Gaur have been shot out to a large extent and opportunity for inter-breeding seldom occurs, Mithun show a considerable differentiation from the Gaur; but it is not till the fourth generation of inbreeding that the Chin Mithun reach the stage of development in which is produced those characters which typify the Mithun and distinguish it from the Gaur. The dome-like ridge between the horns and the concave forehead disappear. The line of the forehead between the horns is straight and the forehead itself flat and the horns show a slight upward curve and lose their inward sweep. If breeding with domestic cattle is continued the high dorsal ridge disappears. The horns become cow-like and the varied colourings of the domestic cow begin to appear. The persistence of Mithun depends then on frequent inter-breeding with wild Gaur. Such inter-breeding is still possible in the hill ranges of Assam. But in the Chin Hills where Gaur have been greatly reduced in numbers and the stock is said to be faced with extermination.—EDS.]

VII.—A LARGE HEAD OF THE INDIAN BUFFALO (*BOS BUBALIS* Linn.)

I do not know if the measurements of the buffalo head now in the bar of the Shillong Club have ever been placed on record in the *Journal*, but I send them herewith in case they have not. The details are taken from the engraved plate on the mount. This enormous head is of a female buffalo whose skeleton was found on the Manas River near Rajachong in February, 1932 by the late Col. P. H. Dundas, C.B., C.B.E., D.S.O.

Measurements:—

Length of horns—Right 62 7/8 in. Left 61 1/8 in.
Girth of horns—Right 19 1/4 in. Left 18 1/2 in.
Widest measurement inside—67 3/16 in.
Widest measurement outside—72 1/2 in.
Tip to tip round outside curve—11 ft. 9 3/8 in.

The Manas river forms the boundary between the Kamrup and Goalpara Districts of Assam. There is nothing to indicate that the animal was a domestic beast and this, I understand, was very unlikely.

R. E. PARSONS,
F.R.E.S.
Indian Police.

NOWGONG,
ASSAM.
September 1, 1939.

[A pair of detached horns of the Indian Buffalo which measure 77 3/8 in.—the largest specimens of their kind were discovered in the year 1885 in a cellar in Wapping by a Mr. Doyle who gave them to Sir Hans Sloane. They are now in the British Museum. The largest head from Assam measures 70 in. and is now in the American Museum of Natural History, New York.—Eds.]

VIII.—MEASUREMENTS AND WEIGHTS OF ELEPHANT TUSKS.

Mr. G. L. D. Millar's note, in the *Journal* of August 1939, on the weight and length of the tusks of his elephant is interesting. According to Rowland Ward's *Records of Big Game* T. H. Monteath shot an elephant with a single tusk in Assam: length: 7 ft. 4½ in.; weight: 85 lbs.

Another large tusker shot in Assam was that of C. N. Shadwell; its tusks were 7 ft. 4 in. and 7 ft. 3 in. in length, and weighed 77½ and 75½ lbs. In South India, Col. F. S. Gillespie shot a rogue elephant, with tusks crossed at the tips, which I believe was a record for South India: length: 8 ft. 2 in.; weight: 91 lbs. and 90½ lbs. (both tusks were of the same length). I was with Col. Gillespie at the time; and the elephant charged us furiously. Curiously enough I shot another very fine tusker, with crossed tusks, in almost the same place a year previously. The tusks of this rogue were crossed within about 18 in. of its jaw; and the elephant must have had considerable difficulty in feeding itself, which probably accounted for its evil disposition; and evil it was: it made a most unprovoked charge. The tusks were 7 ft. 7½ in. and 7 ft. 9 in. in length, and weighed 68 and 63 lbs. An elephant found dead on the Anamallais (S. India) had tusks 7 ft. 10 in. and 7 ft. 8½ in. in length, weighing 82½ and 79½ lbs.

R. C. MORRIS.

Honnametti Estate,
Attikan, Mysore P.O.,
S. India.
September 2, 1939.

IX.—MEMORANDUM ON THE KAHILU SANCTUARY.

(*A correction*).

The illustration of the foot prints of a Rhinoceros which appeared in my Memorandum on the Kahilu Sanctuary (*J.B.N.H.S.* Vol. xli, p. 155) were inadvertently labelled as those of *D. sumatrensis*. Though from their size, it might be assumed, that there is little doubt they belong to this species, it should be noted that this identification has not been definitely established and a query should therefore have been printed after the specific name.

TURF CLUB, CAIRO, D'ARCY WEATHERBE.
November 12, 1939.

X.—OCCURRENCE OF THE ALLIED GREY SHRIKE (*LANIUS EXCUBITOR PALLIDIROSTRIS*) IN THE RAWALPINDI DISTRICT, PUNJAB.

I am informed by Mr. Hugh Whistler that a Grey Shrike (♀) in my collection, which was obtained a few miles from Rawalpindi on the 20th November, 1930, has, with the help of Dr. C. B. Ticehurst, been identified as *pallidirostris*. This is of interest as there are only one or two other Indian records of this race.

H. W. WAITE,
M.B.O.U.
Indian Police.

RAWALPINDI,
PUNJAB.
September 18, 1939.

XI.—SWIFTS AND TERNS AT VENGURLA ROCKS.

It is strange how almost everybody has an inkling of birds' nests being made into soup. This is about all that I can remember of my school text-books, and I have always wanted to see them at closer quarters.

The trip was most unexpected. On Friday, the 3rd February, 1938, Mr. Prater rang up and inquired if I would care to go down to the Vengurla Rocks for the Edible-nest swifts on Monday. French leave was obviously necessary, and I said I couldn't—but that I would see him later in the day. I saw Mr. Prater, and left by the Goa ferry on Monday morning, with Nadir Tyabji, a stray cousin from Burma, and Baptista, the Society's veteran skinner and collector.

The journey down the coast was uneventful. The denuded ghats, washed down to bare, black rock were usually in sight. As soon as one gets south of Bombay, the Large-Crested Tern (*S. bergii*), advertised by its harsh *chirruk* accompanying every dive, is prominent, as also the White-bellied Sea-Eagle (*H. leucogaster*) soaring majestically out at sea.

We looked into both Hume's and Vidal's accounts of the rocks in *Stray Feathers* (iv, p. 419; ix, pp. 44-48), but they appeared unsatisfactory. Hume (February 1875) found no trace of the swifts, and obtained addled eggs, mummies and remains of terns, which he has quite confidently identified as *Sterna anaetheta*. He also found addled eggs which he has referred to one or other of the *Laridae*.

Vidal never visited the islands himself, and merely records that his shikari brought him nests, eggs and parents on several occasions, between February and April. Vidal also records that the rights for collecting the swifts' nests were annually auctioned by Government and yielded about Rs. 30.

Maps indicated that the Vengurla Rocks are part of a semi-submerged reef running more or less parallel to the coast, at a distance of 4 or 5 miles. Hume records that the 'three large rocks, or rocky islands, are entirely metamorphic, and are composed of numerous varieties of quartzo-micaceous rock, mostly more or less ferruginous, and in many places a good deal decomposed and broken-up.'

We landed at Malwan at midnight and were received by Mr. Kalyani of the Fisheries Department. Motor-boats worked by the Fisheries Department were expected in, in a day or two, but in the absence of any definite news, we decided to attempt a landing with a fishing smack. A 20 ft. catamaran was obtained and we left Malwan at 3 p.m., with a stiff north wind blowing.

The Vengurla Rocks, about six miles to the south-west, were faintly visible in the distance, but the fisher-folk were sceptical about the landing. The going was bad right from the start, and we had hardly done a mile, when water was breaking clean over the prow. A large flock of *Sterna bergii* on the reef, was all the bird-life that we saw. Our stores and spirits were soon dampened, and when it was almost dusk the boat-men refused to proceed further, and decided to put in at Kochra. Kochra is at the mouth of a large tidal creek, and the rocks lie about 4 miles due west of it. The boat-men were positive that the wind would die down during the night, and that the rocks could easily be approached in the morning.

We were not particularly optimistic, but decided to have another shot in the morning. While getting into the boat at dawn, I noticed a swift of sorts, rather like a palm-swift, but a little heavier and clumsier, hawking over the mouth of the creek in some numbers. With a hazy notion that we had been visited by the residents of the Vengurla Rocks, we shot a few and the suspicion was confirmed. The birds, probably a hundred pairs, moved further inland along the creek, hawking in a loose, scattered flock.

Luck seemed to be in, and we made for the islands and landed on the eastern shore of the largest island. Of the three islets, the southernmost one bears the light-house, while the old light-house is on the smaller rock to the sea-ward. The island on which we landed was about 400 yards long, and 50-100 yards broad.

The landing was bad, and one had to jump on to a thick layer of *Ostrea* shells that encircled the island at sea-level. The island is high and rocky, and covered with an extremely dense growth of thick, loose-jointed grass. I saw no soil on the island, and the grass grew in a thick layer of guano that covered every portion of the rock, not directly exposed to the brunt of the monsoon.

The grass was everywhere now quite dry, and strewn under tufts of grass, rocks and boulders, were scores of addled and broken eggs, and mummified and desiccated remains of terns. The only birds visible were a flock of about 10 pigeons.

The island rises to a height of about 150 ft., and we soon located the cave which runs into the solid rock for about a hundred yards. The cave is 60 ft. deep and 20 ft. broad, the sides running parallel and vertical. The floor of the cave almost runs on to the ring of shells encircling the island. At the end of the cave, i.e. about 100 yards inland, the roof has fallen in, forming a 'sky-light'. The roof is 5-10 ft. thick.

We had landed without ropes, and descent through the sky-light was impossible. I managed to climb down the cliff on the sea-face, and slowly worked my way into the mouth of the cave. The sky-light arranged for the lighting, and my eyes became accustomed to the gloom in a few minutes. The 60-ft. wall on one side was 'pocked' with innumerable nests of swifts, hardly 6-8 in. from one another. There was not a single bird present. The nests were all just out of reach, and I managed to get a few by clambering up a small ledge. In the meantime, the fisher-folk had produced a rope and Tyabji came down through the sky-light.

We spent some time prospecting on the floor of the cave, and that lizard *Lygosoma* sp., with degenerate legs, was extremely common under the numerous stones and boulders on the floor. Almost every stone over-turned revealed a lizard. A couple of large rock scorpions were also unearthed, but not preserved.

Using the rope down the sky-light, we had a look at the innumerable nests, all swarming with a bug which proved on identification to be the common bed-bug *Cimex rotundatus* Sign. Vidal also records the taking of these bugs from the nests of these birds.[1] The nests were all empty, and in all stages of construction and probably represented the work of many years. I was unable to determine that any of them were fresh, and there was no trace of the pure white variety described by Vidal's shikari. Most of the nests were on the eastern wall (the cave runs north to south), possibly because this wall is better illuminated than the other. The nests, so far as I could ascertain, are no longer collected on a commercial basis.

There was little other life on the island. We found the eggs of a lizard (some form of *Hemidactylus*) on a rocky ledge, and a few insects. The small flock of pigeons contained a semi-albino, and the stomach of one bird shot, contained grass seeds, possibly obtained on the island. The only other birds seen were a white-bellied Sea-Eagle (*Haliaëtus leucogaster*) and a pair of Blue Rock-Thrushes (*Monticola solitaria*), both the species, strangely enough, were seen by Hume when he visited the island some sixty years ago. And instead of a kestrel, we saw a harrier chasing pigeons.

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[1] Dr. Baini Prashad informs us that there are specimens of this Bug in the Indian Museum collected at Calcutta by Dr. Annandale from the nests of the Swift.—Eds.

As I have already stated, the whole of the island was literally strewn with the addled eggs and desiccated remains of terns. A few were collected at random as the boatmen proposed leaving us on the rock, if we did not care to return before the wind turned ! What we obtained was sent to Mr. Hugh Whistler whose report is interesting. The eggs were compared with those in the British Museum, and Mr. Whistler writes:

'One fragment is obviously from a large egg, and agrees with eggs of *Sterna bergii* in colour and texture. All the rest of the eggs and imperfect eggs have suffered from bleaching and rotting, and might conceivably represent one species. All except two agree with the eggs of *Sterna repressa* (olim *albigena*), of which there is a good series in the British Museum. The other two eggs cannot be matched in the B. M. series of *S. repressa* but they do agree with eggs of *Sterna dougalli,* and there is a small series of eggs in the B. M. from the Davidson Collection which are labelled as having come from the Vengurla Rocks, collected by the light-house men, and attributed to this species. I am not aware of what evidence Davidson had for the identification of these eggs as *Sterna dougalli.* The species is not included in his North Kanara list, and I cannot trace any note published by him about these eggs. If it is correct that this species breeds on the Vengurla Rocks, these two eggs probably belong to it. On the other hand, tern eggs vary to some extent, and if I had not seen Davidson's eggs, I should have been content to pass these two eggs as within a possible range of variation for *Sterna repressa.*'

The mummified remains were handed over to Dr. Ticehurst who has reported on them as under :—

'These remains consist of :

(i) Wings and legs which are little more than skeletons, with some feathers attached. From the shape of the wing and the feet, they belong to a large tern, and correspond in size very well with *Sterna bergii.* From the pattern it is evidently a young bird and cannot yet fly, and the pattern of the feathers corresponds well with a juvenile *Sterna bergii* in the British Museum.

(ii) Several wings, legs and heads of a medium-sized tern; some wings and heads are those of adults and some are of half-grown young. From the feathers left on the crown of the adult it is evident that it was a black-capped tern, and therefore could not have been the head of *S. sumatrana.* The remains are too small to be those of *bergii, bengalensis, anglica,* or *caspia,* and geographically they could not be those of *hirundo, macroura* or *longipennis.* The measurements of the adult heads, legs and wings correspond well with *Sterna repressa,* as does the pattern of the adult wing. The juvenile wing has a pattern on the tertials reminiscent of *minuta*, but the remains are too large for any form of that species. Unfortunately there is no specimen of *Sterna repressa* in juvenile dress in British Museum for comparison, but there can be hardly any doubt that the remains belong to that species. There were remains of no other species.'

There is now real evidence that *Sterna bergii*, *anœtheta* and *repressa* breed on the rocks. I missed *anaetheta*, but my collection of eggs and remains was unfortunately haphazard, and I might have overlooked them. Alternatively, tern colonies in England move about in different years, and the same may happen in the Indian Ocean. As regards *dougalli*, apart from Davidson's eggs in the B. M., it might be worthwhile drawing attention to Eha's statement that they breed on the Vengurla Rocks (*Com. Birds of Bombay*, p. 195). On the way back from Kochra on the following morning, we saw the swifts back on the creek, and this apparently is their regular feeding area.

I must confess that the information and material obtained are regrettably incomplete. But I was rushed for time, and an exhaustive survey at any season would cover a couple of days. There is room for extensive and interesting field-work on the islands, but the difficulty of access is always present. A friend has offered to drop me on the island from an aeroplane during the monsoon, and I am waiting for somebody to offer to take me off!

HUMAYUN ABDULALI.

BOMBAY,
October, 1939.

XII.—WOOD SNIPE (*CAPELLA NEMORICOLA*) NEAR BOMBAY.

Herewith the Snipe. It was shot by Mr. H. M. Molesworth last Sunday in tall grass on the edge of a small tank at Ambarnath. Mr. Molesworth says that the tank was situated very close to thick jungle at the foot of a hill, i.e., in a situation in which one often finds Woodcock. I shall be very glad if you will kindly identify it.

M. J. HACKNEY.

IMPERIAL CHEMICAL HOUSE,
BALLARD ESTATE,
BOMBAY.
January 3, 1940.

[The bird is a Wood Snipe (*Capella nemoricola*) an infrequent cold weather visitor to the neighbourhood of Bombay. Two previous records are noted in Mr. Ali's Birds of Bombay and Salsette (*Jour. B.N.H.S.* Vol. xl., p. 642).—EDS.]

XIII.—ON THE OCCURRENCE OF THE BAIKAL OR CLUCKING TEAL (*NETTION FORMOSUM*) IN REWA STATE.

I am writing to inform you that at Mukundpur Jheel in Rewa State on Monday the 11th instant, a 'clucking teal' was shot during the shoot which had been arranged for His Excellency the Viceroy. I think that you would like to know this fact as the 'clucking teal' is, I understand, very rare in those parts.

I should be grateful if, when acknowledging this letter, you would say whether you have any recent records of clucking teal being shot in Rewa State or that part of India.

Viceroy's Camp,
India.
December 16, 1939.

B. M. MAHON, D.S.O., M.C.,
Lieut.-Colonel,
Military Secretary to the Viceroy.

[This duck is one of our rarest winter visitors. There are a few records from various parts of India mentioned in the new *Fauna*. The following are additions to the 7 noted:—1930, Durbhanga (*Dutton*); 1931, Hardoi, U.P. (*Scott Macdougall*); 1933, Kathiar, Bengal (*Murphy*).—Eds.]

XIV.—THE LONG-TAILED DUCK (*CLANGULA HYEMALIS*) IN KASHMIR.

The other day I was asked to identify a duck which H. H. the Maharaja of Kashmir shot on the Hokra Jheel on the 17th October 1939. The bird is a male Long-tailed Duck (*Clangula hyemalis*). The total bag that day was as follows:—

Mallard	Pochard	Teal	Gadwall	Pintail	Wigeon	Shoveller
28	401	745	17	29	4	101

Long-tailed Duck.	Total 1,326
1	

F. LUDLOW.

C/o Postmaster,
Srinagar,
Kashmir.
November 4, 1939.

[The specimen was forwarded to the Society and is a male Long-tailed Duck. There is the 4th record of the occurrence of this duck within Indian limits during recent years. The three previous records are as follows:—1933, Chaman, Baluchistan (*Dredge*); 1935, Mesaki, Sadiya Frontier tract, Assam (*Parsons*); 1936, Drig, Sind (*Lambrick*).—Eds.]

XV.—QUAIL AND CHUKOR (*ALECTORIS GRAECA*).

(*A Query*).

At the end of July in some disused fields near water a large number of chukor were seen coming down to drink. The birds were hens with chicks three-quarters grown and also cock birds. The time was 9 a.m. About a fortnight later these birds were seen in the same area.

At the end of September when the shooting season was opened a drive in this area produced no birds but a couple of quail were shot.

The migratory period of quail up near Sandeman is about early in September.

Can any reader inform me whether it is likely that while the quail are migrating they will—due to their aggressiveness and fighting reputation—drive chukor from their feeding areas near crops. The crops are maize (Indian Corn).

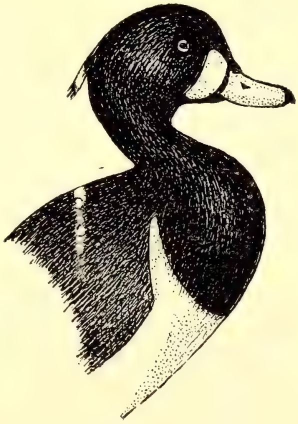
1/2ND GOORKHAS,
FORT SANDEMAN.

C. G. TOOGOOD,
Lt.-Col.,
C.I.E., D.S.O.

XVI.—UNUSUAL COLOURING IN A COMMON POCHARD (*NYROCA FULIGULA*).

(*With a sketch*).

We possess a Common Pochard on our Ornamental Duck Pond at present with a conspicuous white patch on each side of its head, between the eyes and the bill.



This Pochard was purchased in February 1939 from a dealer in Lucknow, along with a number of other Tufted Duck, and White-eyed Pochard, and at that time was exactly like a female Tufted Duck.

After moulting into the eclipse plumage, it has just again moulted out into full Winter Plumage, exhibiting these two very conspicuous white patches.

In every other respect the pochard is exactly like any female Tufted Pochard, the same dusky brown plumage, and whitish under the tail, same white wing bar, in fact, identical. Can you identify the Duck or explain the presence of these white patches? A sketch of the head is enclosed.

LAHORE,
September 23, 1939.

T. W. DEEKS,
Vice President,
Ornamental Pheasant Society of London,
Curator, Zoological Gardens, Lahore.

[Young examples of this Pochard frequently show a streak of white feathers at the base of the bill though these disappear in the adult stage, but normally there is nothing like the white cheek patches shown in the illustration. Stuart Baker, however, in his *Indian Ducks and their Allies,* says that he has in his collection a fine young male which has a white face extending back fully half an inch from the base of the upper mandible and the specimen described above is probably a similar aberrant form. Writing to us on the 2nd February, Mr. Decks says that though 'still conspicuous, the white facial patches are getting smaller and duller.'—EDS.]

XVII.--SNAKE ATTACKED BY FROGS

I was taking my usual early morning exercise near my bungalow two days ago when I noticed a European nearby obviously interested in something happening at the edge of a flooded piece of country. (The monsoon is very heavy at present, and there is a good deal of casual water about.) On joining him I saw a grass snake, about 2 ft. long, struggling with a fat frog in its mouth. A few seconds later, with the frog still in its mouth, it started to swim across the flood water, which was only about 15 yds. wide at this particular place. I noticed innumerable frogs, all croaking like fury, at the edge of the water, and remember wondering at the time what would happen if the snake chanced to land up anywhere near them. This is exactly what did take place, but I was certainly amazed when three or four large frogs immediately attacked the snake which was forced to release its victim. It should be noted that at the time of attack the snake was still in the water, and I presume this would place it at a disadvantage and at the same time allow the frogs to adopt tactics which would hardly have paid on dry land! I wonder if any of your readers have known this happen before?

H. N. CHARRINGTON.

NO. 1, BODYGUARD LINES,
BALLYGUNGE,
CALCUTTA.
Field, August 19, 1939.

XVIII.—PYTHON INFESTED WITH NEMATODE WORMS (*OPHIDASCARIS FILARIA*).

I had a Python about 11 feet in captivity with me since April; colour dull and poor-looking. Lethargic more than usual for these rather slow animals. Took a big dead bandicoot from my hand on August 30, found dead next morning. On dissection found bandicoot undigested in stomach, seen through walls about 8 inches below bottom of lung. Lung collapsed, dark, and found to be almost a mass of red worms, sent now, all sizes hence probably breeding in host. Found some of these on the body of a chicken which was found dead at the same time, a few being always kept in the python pen. May have crawled out of python's mouth when biting, if he bit chicken. Query are these the same as cause gapes in chickens, can they live in either host. Note chickens bought in bazaar are often moribund as dealers pick out those which are ill to sell off quickly. Hence whole pen may be infected by them; am anxious for remainder of pythons (five).

When I got the Python I noticed on part of its body, about where lungs would be, a darkish patch. I thought it might be a stain of earth-oil, petroleum, as I had just had the python-run oiled.

This patch seemed to grow and did not disappear when the skin changed, the Python was always very sluggish, probably due to insufficient oxygen. I presume the patch indicated a certain amount of what might be called inflammation. It lived about two months after I got it.

SEABURY EDWARDES.

10 YARDE STREET,
KAMAYUT P.O.,
LOWER BURMA.
September 9, 1939.

[The nematode worms taken from the lung of the Python have been identified at the Indian Museum as *Ophidascaris filaria* (Duj., 1845) Baylis, 1921. This worm is extremely common in Pythons and has a wide geographical distribution, occurring not only in the Asiatic forms, but also in *Python sebae* in Africa and in *P. spilotes* in Australia. It has also been recorded from a Monitor (*Varanus* sp.) in Zanzibar (Baylis, Parasitology, 1921). The adult forms are found in the intestine. Immature forms have been found on several occasions in the lungs of *Python molurus* and *P. reticulatus*. From this it may be inferred that the larvae go through a course of migration within the body of the host before settling permanently in the intestine. Their sojourn in the lung appears to be of considerable duration, as they may grow to a length of some 60 mm. in this situation. They do not, however, appear to acquire the definitive structure of the lips before leaving the lung.

The adult worms attain a length of about 110 mm. in the male and 170 mm. in the female.

These particular nematodes are exclusively parasites of snakes and so far have not been known to attack other classes of animals. Their presence on the body of the chickens must have been effected by mechanical contact with the python.—Eds.]

XIX.—AN AGGRESSIVE KING COBRA (*NAIA HANNAH*).

(*With two photos*).

I enclose some snaps of a snake. A customer asks whether you can identify it. It was killed on a Tea Estate in the hills behind Tinnevelly after repeatedly attacking a woman. There were no noticeable markings on the back which was black.

M. W. LOWNDES.

Madras,
December 19, 1939.

[The snake is undoubtedly a king cobra. Though famed for its aggressiveness, king cobras like other snakes, will as readily seek safety in flight. Instances of unprovoked attack may generally be attributed to intrusion in the vicinity of the nest.—Eds.]

XX.--FLY FISHING FOR MAHSEER.

(By courtesy of the *Field*).

For many years the largest sizes of March brown, teal and green, and other sea-trout flies have been used for catching the smaller mahseer fish, up to 5 lb. It was not until after a fishing holiday in Kashmir, where we found how successful the peacock and March brown lures were for large brown and rainbow trout in the early months of the season, that we thought of using a large fly for the bigger mahseer. Our first experiments were in the Ganges, in a year when the river was exceptionally low. After spinning spoons and neatly-mounted dead baits had nearly scared the fish, we tried the big fly and found it surprisingly successful.

We were delighted with our 'discovery', only to find later, from the classics of mahseer literature, that this was no new thing; that many a large mahseer had been caught on flies long before our days, but that, in spite of this, the fly was disclaimed, rated one-third as successful as spinning, and rejected in practice. Subsequent years of fishing, in both India and Burma, make me think that judgment requires modification. It is true there are, as at home, some rivers on which the fly is not suitable, but there are many miles of ideal fly water. If the average size of fish caught is smaller than when one is spinning, more fish are caught, and one has the additional joy of playing them on a pliant, lissome fly rod.

On small rivers medium-size flies, 1¼ in. to 2 in. in length, have often been used, but I think that once one finds the trout rod and the sea-trout flies too small for the water, it is better to go direct to use of lures from 2 in. to 3¼ in. Standard patterns such as the Mar Lodge, Silver Doctor and Jack Scott are very good, but very expensive in the larger sizes. Simpler patterns, such as are given at the end of this article, have been found equally effective. These patterns are tied to represent the pale green Chilwa fry, silvery fry such as the Barillius Bola, dark fry like the Kalabanse, and the golden mahseer fry, and have all caught numbers of mahseer. They are tied with two small single hooks, one behind the other, joined with Punjab wire. Large single hooks were found to be far too rank in point and barb and unnecessarily heavy.

After the monsoon rains, when the rivers, as they fall, are still too heavy for the trout rod, yet too small for a heavy spinning outfit, the big fly has caught many fish. During the hot-weather months it is successful in all normal-water conditions, but it has been of most advantage under low-water conditions, when a spoon and dead bait are not attractive.

Let us imagine a wide, stony nullah, dotted here and there with islands of trees or long grass, the river, fast flowing even through the pools, tears its way sometimes in the centre, sometimes on either bank of the river bed. Upstream and to the north, the foothills of the Himalayas rising to 6,000 ft. and more, the weather settled with not a cloud in the sky, the temperature 84 degrees in the shade. Hot? Yes! but the river is cooling, though warm enough to dispense with cumbersome waders. Thus unfettered, everything is set for an ideal day's mahseer fishing. The method we adopt is that used at home for fishing a sunk fly in the summer months. The cast is almost square across the stream to the far bank; line is then pulled in, with small jerks, so as to impart more movement to the lure, and to remove the belly in the line caused by the fast-intervening water. The quick movement of the fly, just after it hits the water, is very attractive to the mahseer, which will often be hooked in the early part of the cast. At times, when fishing very rapid water, the fly may drag on the surface, or, without dragging, move too fast for even the speedy mahseer. Under these circumstances the pace of the fly can be reduced by raising the rod point or by using the greased line method of rolling the line upstream.

Red-letter days, ten fish weighing 95 lb., four fish 45 lb., five fish 57 lb., and sixty-one fish all over 10 lb. in weight in one season, indicate the measure of success, but leave to the imagination the joy and pleasure of catching mahseer on a fly, the most delightful of all methods of angling.

Here are a few successful patterns: (1) *Chilwa.*—Tail, golden pheasant topping; body, pale green seal's fur ribbed with wide silver tinsel; wings, teal; throat, wigeon. (2) *B. bola.*—Tail, golden pheasant topping; body, light silver grey natural fur ribbed with wide silver tinsel; throat, light blue and wigeon; wings, teal. (3) *Kalabanse.*—Tail, golden pheasant topping; body, black seal's fur plus silver tinsel; throat, green and guinea fowl; wings, bronze mallard and a narrow band of teal. (4) *Mahseer.*—Tail, golden pheasant topping; body, light silver grey natural fur ribbed throat, red golden pheasant breast feather; wings, brown black turkey with white tips overlaid with brown mallard; cheeks, chatterer. The dubbing of the bodies is very freely picked out in all cases.

J. R. M.

MAY 20, 1939.

XXI.—THE FISH *MEGALOPS* AS AN AID TO COMBAT THE GUINEA-WORM CARRIER *CYCLOPS*.

The prevention of infection by guinea-worm disease has engaged the attention of investigators all over India. Papers in various scientific journals attest to the work done on the subject. Guinea-worm infection, as is well-known, is caused by the swallowing of a microscopic crustacean, or water flea (*Cyclops*) when drinking water. The disease manifests itself in human beings if the Cyclops swallowed happen to carry larvae of guinea-worm. The disease is not unknown in the Bombay Province and is endemic so close to Bombay as in the Kolaba district.

Attempts to control the disease here were made in 1928 by Rao Saheb Y. M. Pradhan, M.C.P.S., who was specially deputed as Health Officer to investigate the disease. His investigations disclosed that on an average 10% of the population there was infected during the endemic season, i.e., from February to May, and that the disease reached its maximum incidence in April.

The Cyclops as is well-known, is the intermediate host of the guinea-worm. A good deal of research on this pest has accordingly been directed to the discovery of a suitable fish that will feed on the Cyclops and in whose stomach the larvae of the guinea-worm may be destroyed. Rao Saheb Pradhan and other workers in the field elsewhere in India experimented with different varieties of fish to destroy the Cyclops. The fishes employed by Rao Saheb Pradhan were:—

Rasbora daniconius, Haplochilus lineatus (panchax), *Barbus phutunio, Polycanthus cupanus,* and *Nemachilus.*

Dr. V. N. Moorty, Guinea-worm Research Officer, Department of Health, Mysore, in his investigations in the Chitaldrug district where the disease is rampant used the following fishes:—

Barbus (Puntius) *puckelli, Barbus* (Puntius) *ticto, Barbus sophore, Barbus chola, Lepidocephalocythys thermalis, Rasbora daniconius,* and *Gambusia.*

The fishes employed by both investigators were fresh water fishes. Both authors merely state the extent of the partiality of the various fishes for Cyclops, but they do not record what their investigations of the stomach contents of the fishes showed.

The value of the use of fishes to destroy Cyclops is self-evident. It would not only be more effective and safer, inasmuch as it would obviate the risk of endangering the purity of the water supply by the introduction of chemicals, but would be economical as it could be carried out without excessive expenditure. Dr. Moorty calls attention, however, to an important factor, which is that fresh water fishes of any species do not thrive efficiently enough in step wells in villages infected with guinea-worm.

A fish that may effectively exterminate the Cyclops in wells and ponds, in our opinion, seems to be *Megalops cyprinoides.* We have been experimenting with various fresh water fishes to gauge their suitability to stock sheets of water in pursuance of Government's scheme to develop the fresh water fisheries. The stomach contents of the fishes selected for the experiment were examined at the same time as their rate of growth and life history were being studied. Fingerlings of *Megalops,* of which the stomach contents were examined varied from 1 in. to 4 in. in length. The stomach consisted almost exclusively of cyclops. *Megalops* of also larger size, measuring in length about 7 in. and collected from large ponds, showed that the food material in the intestinal tract consisted predominantly of cyclops and to a less extent of fragments of other crustacea, and larvae of aquatic insects. The ponds abounded in other food material also, but the megalops manifested a decided predilection for cyclops.

The observations thus indicate that the Megalops in its early stages, at least until the time it attains a size of about 4 in. is essentially a selective feeder. Even in later stages the fish continues to consume *Cyclops.* This evidence seems to lend ground to the view that wherever the fingerlings of *Megalops* are introduced, they will tend to feed on *Cyclops.* The problem for investigation is to determine the size up to which fingerlings of *Megalops* subsist chiefly on *Cyclops.* Even if it be established that fingerlings up to only a certain size are useful for the destruction of *Cyclops,* there should be no difficulty in obtaining such fingerlings for stocking purposes, as fry and fingerlings are available in large numbers every year around our coast.

An examination of other fishes, including, among others, some of those listed by R. S. Pradhan and Dr. Moorty, which were dissected by us, showed but insignificant quantities of cyclops in their intestinal tract. The investigation also showed that several fresh water fishes, some to a greater, others to a less extent, feed on cyclops, but *Megalops* stands out amongst all as a voracious and selective feeder of the pest.

Megalops is a marine fish. It breeds in the sea, and the fry during the monsoon moves up to puddles or ponds of fresh water which border creeks and flow into the sea. The fry of this fish is remarkably abundant in such puddles and may be collected in copious quantities for distribution in either fresh or brackish water where the occurrence of cyclops is notorious. A striking characteristic noted about the fish in the Kolaba district is its distribution in large quantities close to the sea specially at such places as are afflicted with the guinea-worm.

Other characteristics of the fish are its remarkable adaptability to any type of environment. It flourishes equally vigorously in fresh water as in dirty muddy water as well as in step wells. It is extremely hardy and seems to be an air breather. It can be transported with ease over long distances to wherever the pest occurs. Its suitability for the eradication of the guinea-worm can only definitely be established by its intensive introduction in areas where the incidence of the disease is now great.

Observations of this department are of the sketchiest kind and no finality can be attached to them. Further investigation will be necessary before it can be established with certainty that the *Megalops* is the best agent for the destruction of the pest. The object of the note is to draw attention to the possibility of the usefulness of *Megalops* in this direction.

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Fisheries Officer,
and
C. V. KULKARNI,
B.A., B.SC.,
Piscicultural Assistant,
Department of Industries, Bombay.

[Wallinger in a note in the Society's *Journal* (Vol. xv, p. 720) refers to the ready adaptibility of *Megalops cyprinoides* to life in fresh water. Fingerlings 3 in. in length put into a stock tank by him in the month of July had by the following April reached a length of 10 in. and a weight of $\frac{1}{4}$-$\frac{1}{2}$ lb. He recommends the stocking of tanks with this fish because of its marvellous fly-taking propensities. The authors of the above note now provide an additional recommendation. It seems clear that fingerlings of this fish feed largely on Cyclops: but the question arises as to the extent to which cyclops form the food of adult fishes. The limitation of the destruction of Cyclops mainly to the fingerling stage in *Megalops* would reduce its utility as a destroyer of this pest, particularly, as we have no evidence so far to indicate that *Megalops* breeds in fresh water.—EDS.]

XXII.—A CASE OF RECOVERY FROM THE BITE OF THE SAW-SCALED VIPER (*ECHIS CARINATA*).

The attached Medical Case Sheet in respect of a case of snake bite *Echis carinata* which was admitted to the Indian Military Hospital, Bangalore on the 23rd September 1939 is forwarded herewith.

Date	History	Treatment
23-9-39	The patient states that he was bitten by a small snake on his left middle finger while cutting grass at 14·00 hours. He was immediately taken to British Military Hospital. 15.10 hours. Blood stained vomit. 15·20 hours. Blood stained vomit.	14·25 hours. He was given 30 c.c. anti-venene concentrated intravenously and incision made at site of bite and potassium permanganate crystals applied. 17·00 hours. 20 c.c. concentrated anti-venene given intravenously and 2 c.c. Calcium gluconate and 1·5 c.c. Coramine intravenous.
	17·30 hours. Condition of patient improved and he was sent to Indian Military Hospital. The colleague of the patient had killed the snake and on the following day it was brought to Indian Military Hospital where Lieut. G. J. Ferris, I.O.M., I.D.S.M., I.M.D. Sub-Charge, identified it as 'ECHIS CARINATA', and this was subsequently confirmed by Natural His. Society of Bombay. **Condition on Admission.—(Indian Military Hospital)**	
23-9-39	Temperature 99.5, Pulse 100, Respiration 22. Patient looks anxious, excited and trembling. Patient was assured that he would recover completely which gave him courage and tended to allay his anxiety and excitement somewhat.	Glucose by mouth ½ oz. every hour. Keep warm in bed and hot coffee every two hours.
23-9-39	21·30 hours. Patient feels much better but complains of pain at site of wound.	
24-9-39	Oozing at site of wound. Oozing continued till 29-9-39 when it stopped. Mouth foul due to ulcers on the buccal mucous membrane.	Calcium lactate 15 Gr. T.D.S. Condy's gargle.

Date	History	Treatment
2-10-39	Temperature 102.0 Pulse 116 Respiration 26, Mouth foul. Patient looks ill, Haemorrhage from ear started. Patient placed on S. I. List.	Calcium lactate 31 gr. T.D.S. Serum (Intramuscular) given to check haemorrhage. In absence of plain horse serum anti-Dysenteric serum 40 c.c. administered. Condy's gargle.
5-10-39	Temperature 101°, Pulse 94. Respiration 26. Patient better. Removed from S. I. List.	
9-10-39	Haematuria started. The haematuria continued and slowly decreased day by day. Slight paralysis of tongue noticed, and patient finds difficulty in putting the tongue out.	Calcium lactate 31 gr. T.D.S. Serum given to check haemorrhage. Condy's gargle. Strychnine injection 1/60 Gr. 9-10-39. Do. 11-10-39. Do. 13-10-39.
13-10-39	Urine completely free from blood. Patient can protrude the tongue.	Condy's gargle.
17-10-39	Patient is convalescent.	
2-11-39	Making good progress. Patient completely recovered and discharged to duty.	

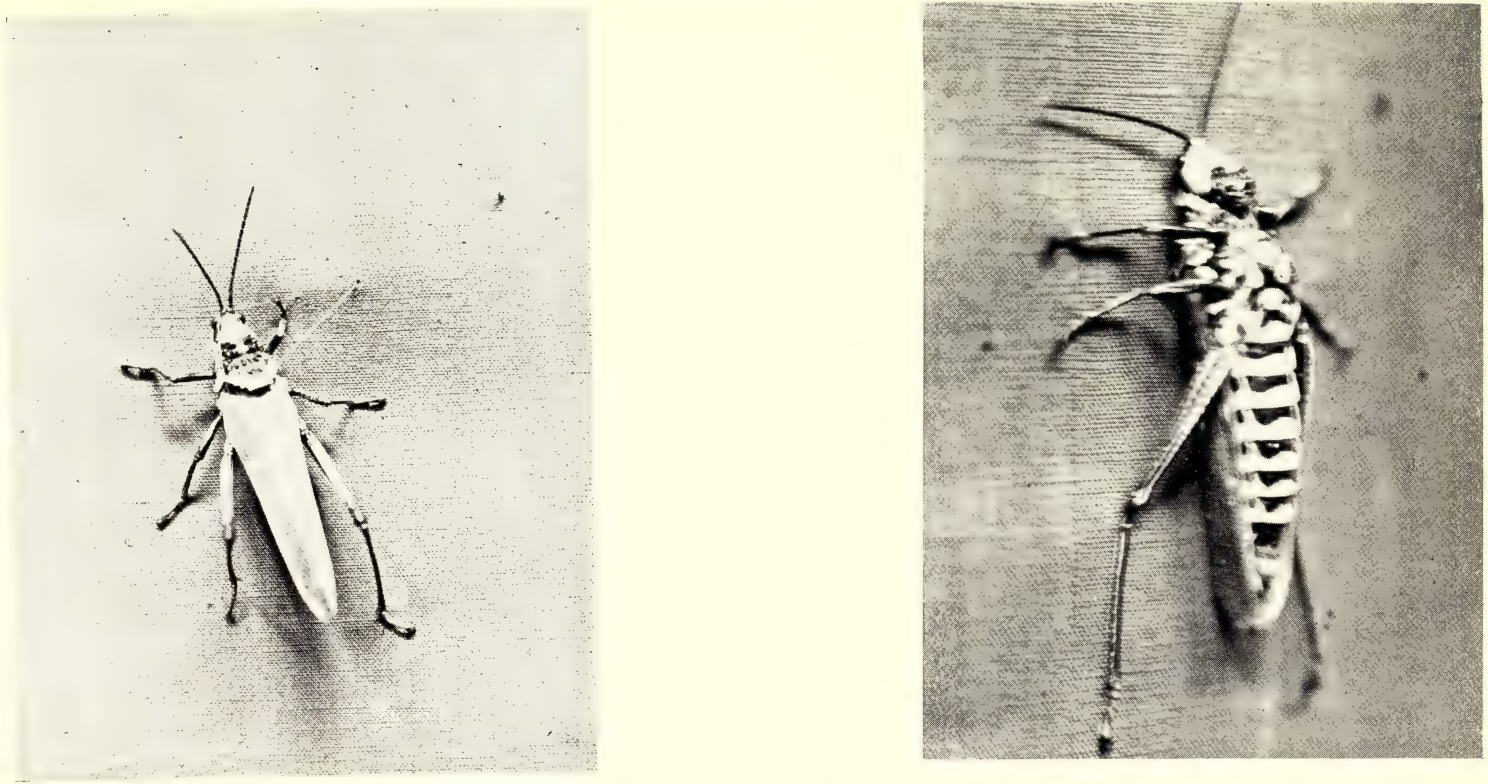
R. SEN,
Lt.-Col., I.M.S.

November 24, 1939.

XXIII.—A VISITATION OF THE SPOTTED LOCUST (*AULARCHES MILIARIS L.*) IN TRAVANCORE.

(*With a plate*).

Kirby (1914) describes three species of *Aularches* in India viz.; *A. miliaris, A. punctatus* and *A. scabiosae* and further states that according to certain workers the two latter species are only varieties of the first-mentioned one which forms the type of the genus. This opinion appears to be correct in view of the close resemblance of the three forms. *A. miliaris,* also known as the Coffee Locust (Lefroy, 1909), due to its frequent occurrence in large numbers in coffee plantations, in Ceylon, is known to be an occasional serious pest. (Green, 1898 and 1906 and Hutson, 1926 and 1928). The Ceylon and Travancore forms are identical and both belong to the same species, *scabiosae* (Photographs, 1 and 2). During normal years when there are no swarms, isolated insects are found in the plains and in the hilly tracts. They are easily



Dorsal view.

Ventral view.

The Spotted Locust (*Aularches miliaris* L.).

identified from every other grasshopper by their characteristic warning coloration, and by the secretion given off from the sides of the thorax which froths up on coming into contact with air and gives a very unpleasant smell when handled.[1]

Locusts and serious grasshopper pests are practically unknown in Travancore and the only previous record is of an outbreak of *A. miliaris* (*scabiosae?*) at Manimala near the lower slopes of the Western Ghats in Travancore about eighteen years ago. There has been a recent outbreak of this pest in a serious form at Kalanjoor in Central Travancore about ten miles to the north of Punaloor (Railway Station). The attack was first reported during the middle of June 1939 a fortnight after it was noticed. The insect was first observed in the young teak plantation at Valiakonam, Kalanjoor; but in the beginning no importance was attached to it by the local ryots. When after a complete defoliation of the teak trees the vanguard of the swarm invaded the cultivated areas panic began among them. The following are the more important of the trees subjected to attack:—teak, coconut, mango, areca, jack and plantain. The swarm which was at first moving as a body divided at the middle of June into two, one proceeding towards the west into the cultivated area mostly attacking isolated teak trees and the other towards the south into the Vazappara teak plantation, and gradually got scattered in different directions. During the peak of the attack the whole swarm occupied roughly an area of about quarter of a mile long and fifty yards wide.

The grasshoppers seldom came to earth except by accident and hence none of the ground crops like tapioca and rice were affected. Their preference for teak leaf was remarkable and it was not unusual to see the branches of this tree bent down by the weight of the pest. Every leaf had on an average from twenty to thirty insects and due to their protective coloration it was hard to detect their presence except for the chirruping noise they made and the continuous fall of the faecal pellets. When disturbed they always moved forwards in the direction opposite to that whence they came.

Little is known about the life-cycle of this pest in Travancore. Since it is of greater economic importance in Ceylon the life-history has been worked out there and it is briefly as follows. The winged adults which come out during the latter half of July begin mating from the third week of August, and about the middle of November they congregate in large numbers on the ground for egg-laying. Eggs as usual are laid in masses in the earth by inserting the abdomen into it. No preference is shown to any particular type of soil. Each egg mass is about 1.5 to 3 inches long containing on an average about 80 eggs. The adults die soon after oviposition. Eggs are pale yellow or honey-coloured when freshly laid and turn darker as development progresses. The eggs take about four months to hatch out and the young nymphs come out in April. Under normal conditions they pass through six instars and the nymphal period on an average ranges from five to six months. The adults live for about 5 months. There is only a single brood every year. In Travancore judging from the recent attack the winged adults appear to come out in June, earlier than in Ceylon.

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[1] This interesting phenomenon met with in certain insects is given in detail by G. D. H. Carpenter and H. Eltringham in *Proc. Zool. Soc. Lond.* Vol. 108, Ser. **A.** Part II 1938, pp. 243-252.

As the adults always remain on the tops of trees control measures are possible only either during the hopper stages when they are devoid of wings or when they congregate in large numbers in the ground for egg-laying. Very young nymphs may be killed by spraying them with soap solution and egg masses can be dug out and destroyed. Shaking the plants on which the adults congregate and handpicking those that fall to the ground may also be effective. Natural enemies appear to be few for this pest.

I am indebted to Dr. J. C. Hutson, Agricultural Entomologist, Ceylon, for kindly sending me references regarding this pest there.

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TRIVANDRUM. S. JONES.

XXIV.—ASSOCIATION BETWEEN *BATOCERA RUBUS* L. AND BOOK-SCORPIONS (*CHELIFER*).

On the evening of December 1, at Andheri, Salsette Island, a large Longicorn beetle (*Batocera rubus*: *Cerambycidae*) attracted by the light, flew in through my window. On examining the specimen I noticed a Book-Scorpion drop off it. A little later another appeared from under the wing-cases. On lifting the wing-cases another nine came to light. On critical examination under the microscope I discovered that both the beetle and the Book-Scorpions were infested with minute mites probably of the family *Tyrogbyphidae.*

The presence of Book-Scorpions on the bodies of insects is well-known, this record fixes the identity of one of the carriers in India. Book-Scorpions are not parasitic, but feed on minute animal life, and one is naturally tempted to seek an explanation for their presence in such a number on a single insect. The only suggestion that offers itself seems to be that the Book-Scorpions feed on the mites which infest their hosts, and are therefore beneficial to the insects in that they reduce the insects' body parasites. This reason appears quite plausible as they must be attracted to inhabit the body of the beetle by something, not merely for the sake of transport! An examination of another beetle that came in the following night showed that there were no Book-Scorpions present, but at the same time the number of mites was very small. This seems to show that there is some relation between the presence of the mites and the Book-Scorpions.

C. McCANN.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY.
December 4, 1939.

XXV.—ON *FREREA INDICA.*

Mr. McCann's interesting article on *Frerea indica,* p. 143 of your August number.

I had this plant at Kate's Point, Mahabaleshwar, in October 1924. I have never again been to Mahabaleshwar in the cold weather, and so have not seen it again. The specimen I took for my herbarium is still recognizable and has leaves as described and pictured by Mr. McCann; the flowers have parted from the stem. Perhaps Mr. McCann would like to call and see the specimen.

The rough note made at the time was as follows.—'On outcrop 'rock exposed to sun. The flower is brown purple with v-shaped 'yellow markings and interrupted yellow lines. Lobes of corolla 'sometimes six'.

Its close, but leafless, relation *Caralluma fimbriata* is common on the bare grassy hills round Kolhapur, where it grows in small clumps in the shade of prickly pear, flowers in the rains, and produces very long thin follicles in the cold weather. I also noted it (*Caralluma*) in the Kamkhed taluka of Ahmednagar.

R. D. BOMBAY.

BISHOP'S LODGE,
MALABAR HILL,
BOMBAY 6.
December 22, 1939.

XXVI.—ON THE OCCURRENCE OF *CICHORIUM INTYBUS* LINN. (*Chicory*) IN HYDERABAD, DECCAN.

(*With a plate*).

Cichorium Intybus Linn., a native of Europe naturalised in America and familiar to many as a weed, is a pot herb, a salad, and the leading adulterant of Coffee. It is chiefly cultivated for its leaves and roots. It is common in Simla, N.-W. India and W. Asia. There is no record of its having been grown in the Deccan. Cooke in his Flora of the Presidency of Bombay says that Chicory is rarely grown in the Deccan. Gamble in his Flora of the Presidency of Madras mentions nothing about this plant.

Last year in the month of October the writer by chance visited a place known as the Lingampalli Canal and came across a single plant of *Cichorium* in flower (Fig. 1.), which was an altogether unexpected occurrence. A few months later the writer visited the place again and found a single withered plant which was uprooted to see if there were any tuberous roots. There were none. Thinking that it might be an escape, enquiries were made from the Florists in Poona and Bangalore if they supplied seeds of Chicory. They expressed their inability to supply the seeds of Chicory as it was not grown either in the Bombay Presidency or in Bangalore.

The replies aroused more interest in the writer and the place was visited again in August, 1939 in the early rainy season. It was a matter of great delight to find a large number of young plants of Chicory (Fig. 2) growing wild amongst other more vigorous plants, such as *Amarantus spinosus* Linn., *A. oleraceus* Roxb., *Portulaca oleracea* Linn., *Sclerocarpus africanus* Jacq., *Vernonia cinerea* Less., *Phyllanthus Nirurii* Linn., *Cynodon dactylon* Pers., several species of *Euphorbia,* and others. It was further noted that as the hardier plants spread more and more they seem to limit and overcome the new-comers (Chicory). In spite of this struggle and the disadvantage of a new environment some of the plants of Chicory survived and bore flowers.

Since Chicory is a useful pot-herb and needs no special attention and care as has been observed by the writer, it is advisable to introduce it on a large scale not only in the Deccan but elsewhere also. The climatic and edaphic conditions of the Deccan seem to be quite favourable for the growth of this plant.

M. ABDUS SALAM.

Department of Botany,
Osmania University,
Hyderabad (Dn.),
September 30, 1939.

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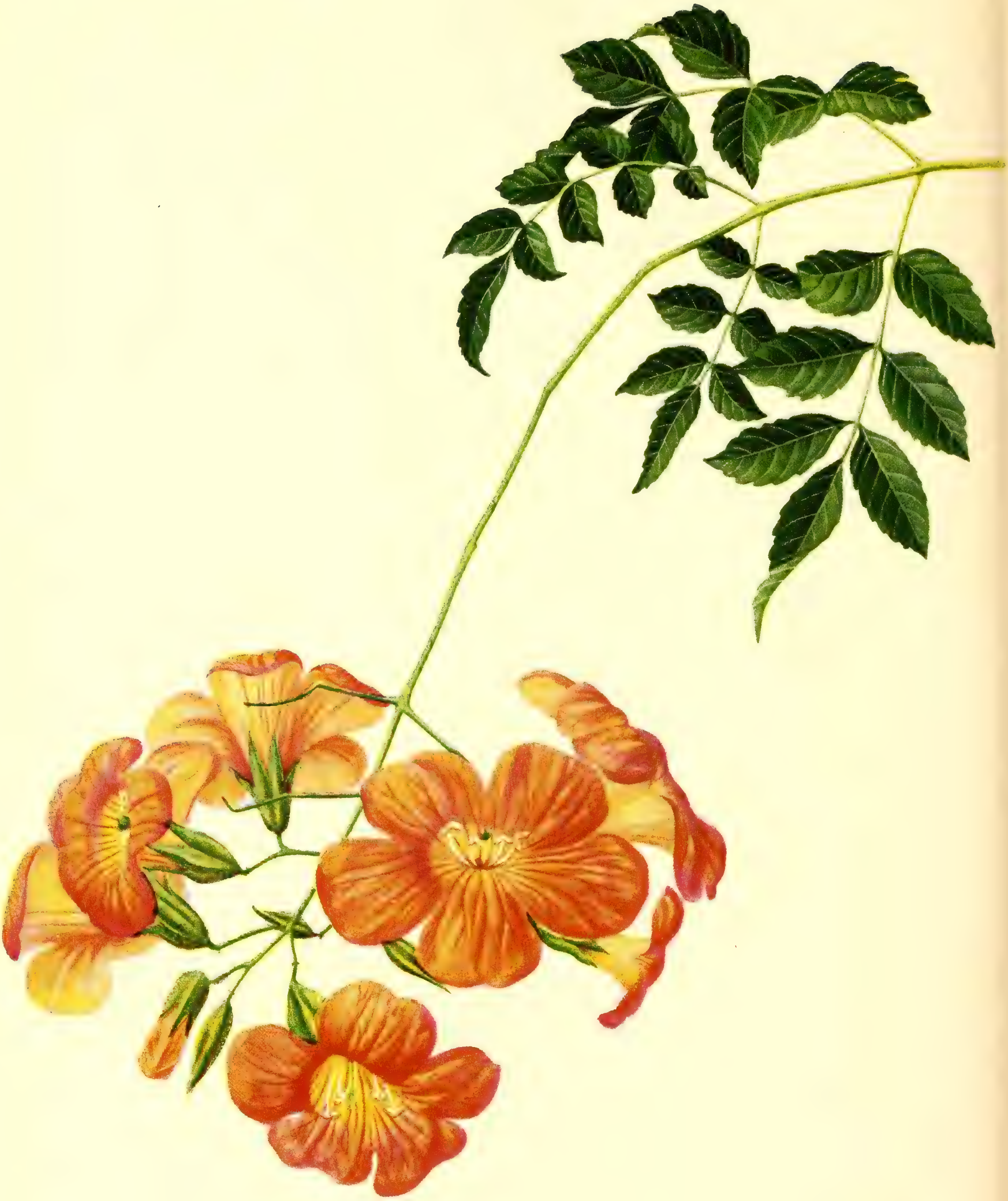

John Bale, Sons & Curnow, Ltd London.

Large-flowered Tecoma.
Tecoma grandiflora, Delaun.
(5/9 nat. size)

JOURNAL
OF THE
Bombay Natural History Society.

1940. VOL. XLI. NO. 4.

SOME BEAUTIFUL INDIAN CLIMBERS AND SHRUBS.

BY

N. L. BOR, M.A., D.SC., F.L.S., I.F.S.,
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AND

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PART IV.

(*Continued from Vol.* xli, *No.* 3 (1940), *p.* 460).

(*With one coloured and four black and white plates, and five text-figures*).

Tecoma Juss.

A genus of the *Bignoniaceæ*. The name itself is derived from the Mexican term for a plant, *Tecomaxochitl*, which means 'vessel-flower' and refers to the large cup-shaped or trumpet-shaped blooms.

The genus *Tecoma*, as known to botanists, contains plants with a shrubby habit, but horticulturists in India include several scandent species, now known by other names, in this genus.

The species of *Tecoma*, in the horticultural sense, are deservedly popular in Indian gardens, not only for the large size and profusion of their gorgeously coloured flowers, but also for their extremely handsome foliage.

In the scandent species treated in this article the methods of climbing are either by the production of aerial rootlets from the nodes which clasp the support, or by simple twining round a support.

The leaves of our species are opposite, exstipulate and may be evergreen or deciduous. The leaf is compound and odd pinnate with entire or toothed leaflets.

The flowers, which are large and showy, are borne in terminal or axillary panicles or racemes. The calyx is gamosepalous,

NOV 13 1940

tubular, with five lobes. The corolla is gamopetalous, more or less irregular, campanulate, or funnel-shaped with five lobes.

Stamens five, of which one is rudimentary, inserted on the corolla tube alternate with the lobes. The ovary is seated upon a fleshy disk and may be one or two-celled, with many ovules attached to parietal placentae. The style is slender and divided into two stigmatic lobes. The fruit is a capsule, septicidal or loculicidal. The seeds are furnished with papery wings.

Glandular hairs are developed on the aerial parts of several species of *Tecoma*. Parija and Samal who investigated these structures in *Tecoma capensis* came to the conclusion that they were hydathodes or water secreting organs. The importance of the hydathodes lies in their power to secrete water when transpiration is suppressed, an arrangement which prevents the hydrostatic pressure within the conducting system from becoming excessive, and hence protects the ventilating system against the danger of flooding (Haberlandt).

The same two investigators discovered glandular areas on the floral parts of *Tecoma capensis*. They proved that these glands (extrafloral nectaries) secrete glucose and cane sugar, and that they are active long before the sexual parts of the flower are mature. This being so, it seems that the large black ants which visit these nectaries in crowds day and night have nothing to do with the pollination. Some insects, instead of entering the mouth of the flower to reach the floral nectaries developed at the base of the corolla, and so assisting the plant in cross-fertilisation, bore through the base of the corolla and steal the honey. It is possible and even probable that the presence of ants on the extrafloral nectaries prevent insect robbers from getting their booty in this way without working for it. Pariia and Samal, however, consider that the extrafloral nectaries prevent the ants from visiting the flowers and so favour self-fertilisation. Cross-fertilisation is, however, extremely likely in view of the fact that intrafloral nectaries are developed in the brightly coloured corollas.

Tiwary has given some account of the pollination of *Tecoma radicans*. The flowers are protandrous and the anthers are found to have completely dehisced even before the flower is open. The bifid stigma of the immature ovary, with the halves closely pressed together, remains tucked away behind the filaments. The honey is secreted at the base of the corolla and is capable of being extracted by long-tongued insects. The flowers are much visited by bees which remove quantities of pollen. Subsequently the style elongates and the stigmatic lobes separate. Cross-fertilisation is now possible. Tiwary concludes that cross-fertilisation does not take place because long-tongued insects do not visit the flowers, but surely the pollen gatherer can perform this service just as well. Black ants are also found on the calyx and corolla of this plant, and they may exercise the same function as in the case of *Tecoma capensis*.

The presence of ants, however, cannot prevent sun birds (*Arachnecthra asiatica*) from boring a small hole at the base of the corolla and stealing the honey. They are often seen hovering about the flowers of *Tecoma stans* at Dehra Dun.

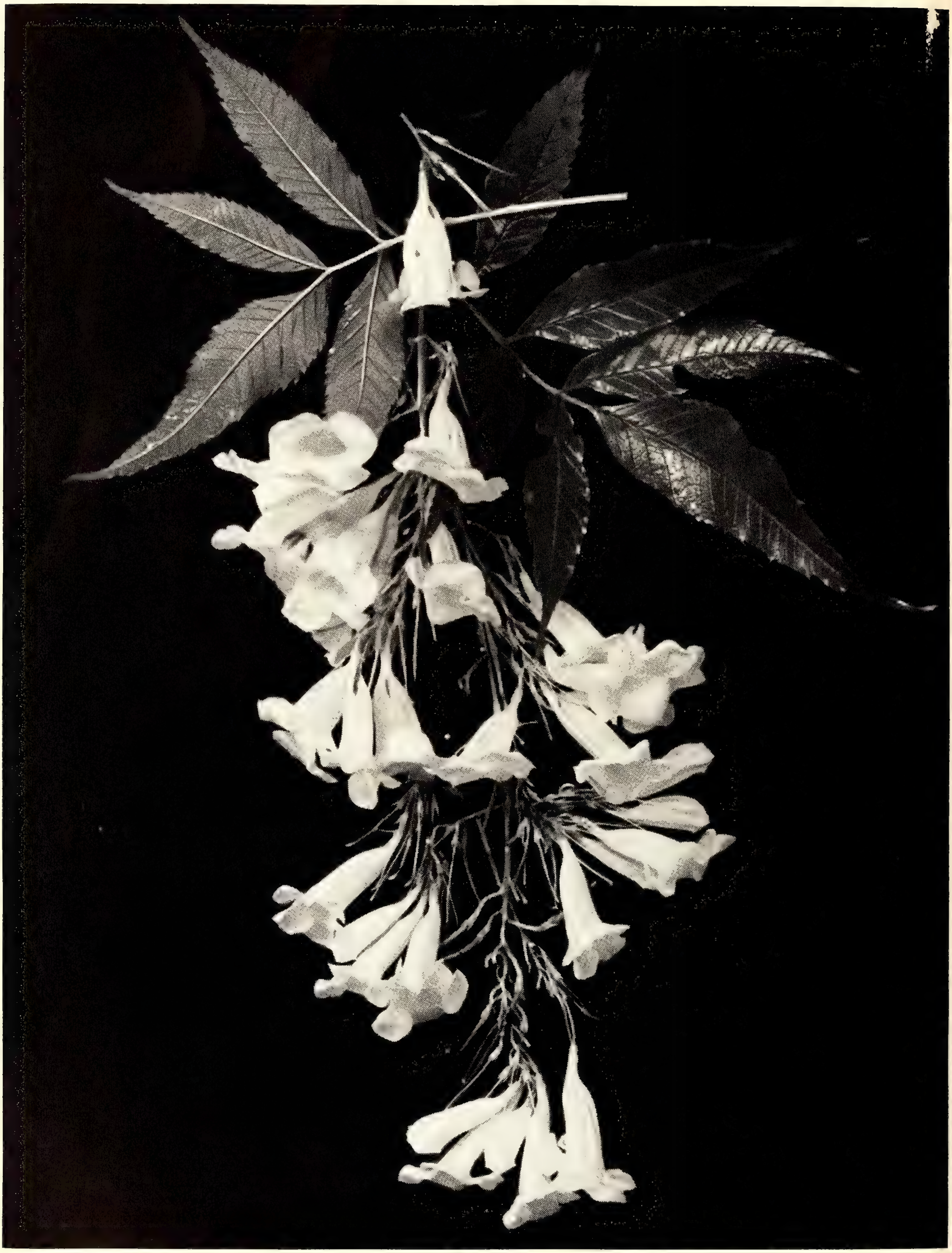

Photo by M. N. Bakshi.

The Yellow Elder or Trumpet-Flower (*Tecoma stans* (Linn.) H.B.K.).
New Forest, Dehra Dun.

KEY TO THE SPECIES.

Shrubs ... ...*T. stans.*
Climbers
Stamens exserted ... ...*T. capensis.*
Stamens included.
Flowers scarlet or orange; climbing by aerial rootlets.
Leaflets 9-11, pubescent beneath, at least on the midrib; calyx teeth short ... ...*T. radicans.*
Leaflets 7-9, glabrous beneath; calyx 5-lobed to middle ...*T. grandiflora.*
Flowers white, yellowish or pink, climbing without aerial rootlets.
Corolla 1.5-2 in. long ... ... *T. jasminoides.*
Corolla .5-.75 in. long ... ... *T. australis.*

Tecoma stans (Linn.) H. B. K.

The Yellow Elder; Trumpet-Flower.
(The specific name means 'erect' in Latin).

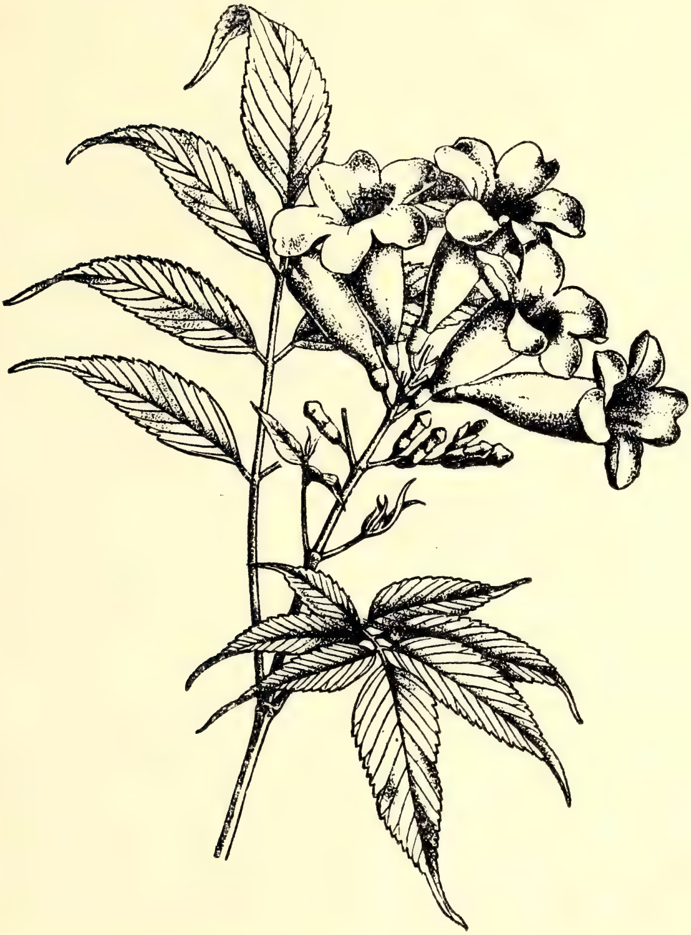

Fig. 1.—*Tecoma stans* (Linn.) H.B.K. ×¾.

Description.—A large shrub sometimes reaching the size of a small tree. The leaves are opposite, compound and odd-pinnate, 4-8 in. long. Leaflets opposite, 5-11 in number, ovate, ovate-oblong to lanceolate in shape, 1-4 in. long, acuminate, sharply serrate, sessile or nearly so. The new leaves are a beautiful glossy green but the foliage looks very tired after a cold winter and dry hot weather. It is usual in older trees to see a profusion of erect shoots from the base of the stem. These shoots bear flowers.

The flowers are borne in large terminal panicles and are fragrant. Calyx cup-shaped with 5 narrow lobes, glabrous or sparsely covered with short crisp hairs, .2-.3 in. long. Corolla gamopetalous, of a beautiful yellow-gold colour, contracted to a narrow tube at the base, expanding above the calyx into an irregular funnel with five wavy lobes. Stamens four fertile; one rudimentary, included inside the corolla tube. This is the usual arrangement but one often finds only three fertile stamens and one unfertile anther on a filament only half the normal length. The anthers are widely divergent from the apex and the connective is crowned with a small foliaceous limb. The ovary is seated in a cupular disk which is wavy on the margin. The style is long and filiform and divides at the apex into 2 stigmatic lobes. The capsule is linear, 6-9 in. long, compressed, green, turning brown at maturity, and contains numerous seeds, each with 2 large thin wings. The eastern and southern sides of a bush flower first and by the time the pods have replaced the flowers, the northern and western aspects flower.

Flowers.—Practically throughout the year. The capsules are produced during the cold weather and remain hanging for a long time on the plant.

Distribution.—Native of Tropical America. Very common in gardens in the plains throughout India. It is also found in the hills up to 5,000 ft.

Gardening.—This species grows exceedingly well in our gardens and flowers profusely. Owing to its rapid growth and dense foliage down to the ground, the 'yellow elder' is highly valued as a screen for unsightly objects. It ripens its seeds so abundantly that hundreds of seedlings come up self-sown around old plants. Easily raised from seeds sown in March.

Tecoma stans (L.) H. B. K. var. *incisa* Hort. is a form in which the leaflets are narrow and are cut almost to the midrib. A plant with very graceful foliage.

Tecoma capensis Lindl. [**Tecomaria capensis** (Thunb.) Spach.]
The Cape-Honeysuckle.

(The specific name indicates the origin of the plant).

Description.—A rambling shrub about 6 ft. high. Stem and branches slender, brown, with prominent raised lenticels. Leaves opposite, compound, odd pinnate. Leaflets 7-9, .5-1.5 in. long, broadly ovate to almost orbicular in shape, glabrous, shortly petiolate, coarsely serrate; teeth often obtuse.

Inflorescence a peduncled terminal raceme. Flowers seated on pedicels up to .5 in. long. Calyx gamosepalous with five regular

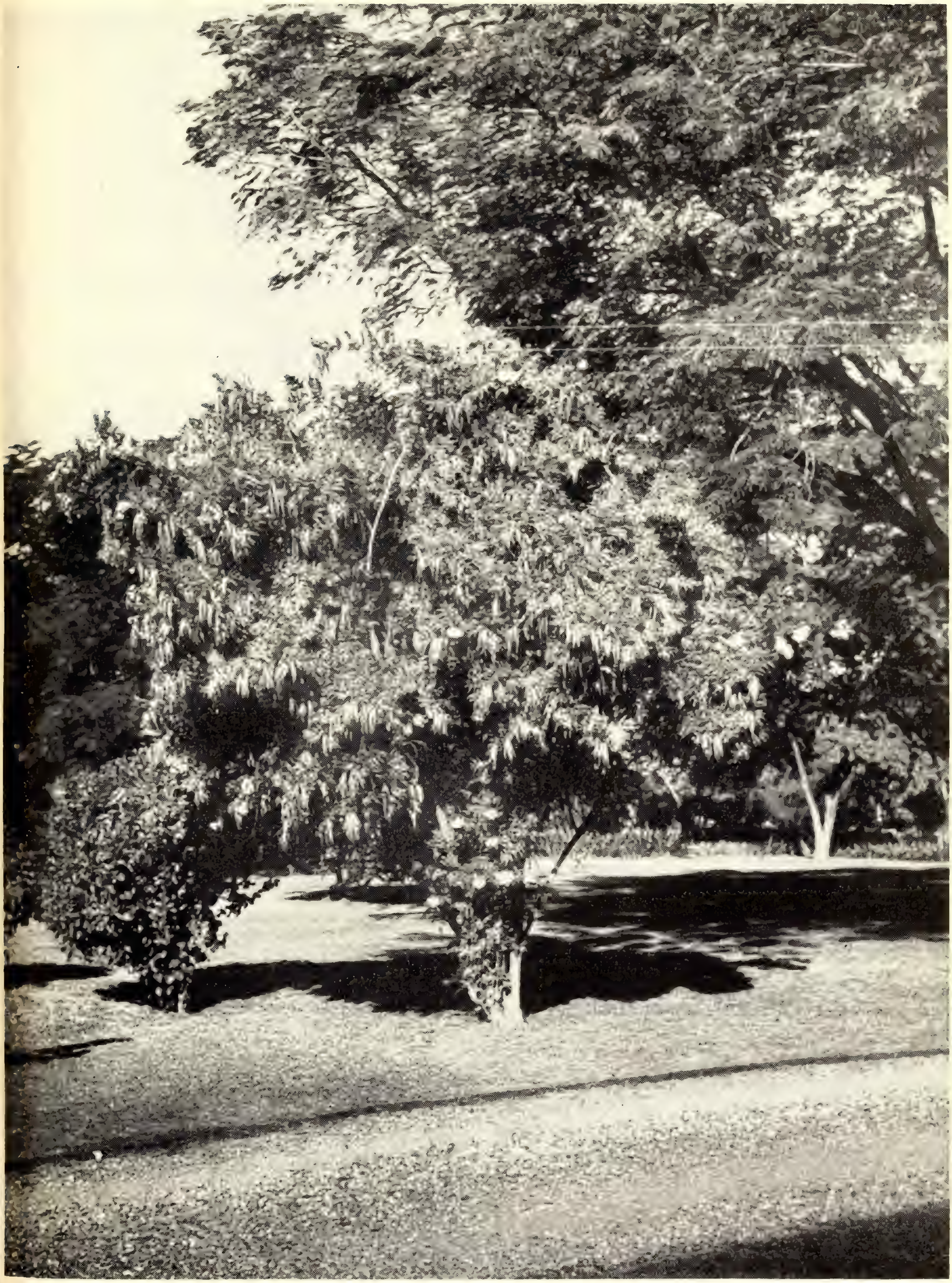

Photo by N. L. Bor.

The Yellow Elder or Trumpet-Flower (*Tecoma stans* (Linn.) H.B.K.).
New Forest, Dehra Dun.

triangular teeth, .2-.25 in. long, cup-shaped. Corolla tubular or funnel-shaped, slightly curved, gamopetalous, 2 in. long, orange or scarlet or flame-coloured, ending in four lobes the upper of which is notched. Fertile stamens four, inserted on the corolla tube and alternate with lobes. Anther-cells spreading at the apices of the filaments which are longer than the corolla tube. The connective projects as a small knob above the anther cells. Ovary oblong; seated in a cup-like disk. Style long, slender, ending in two stigmatic plates. Fruit a capsule usually 2 in. but occasionally up to 4 in. long.

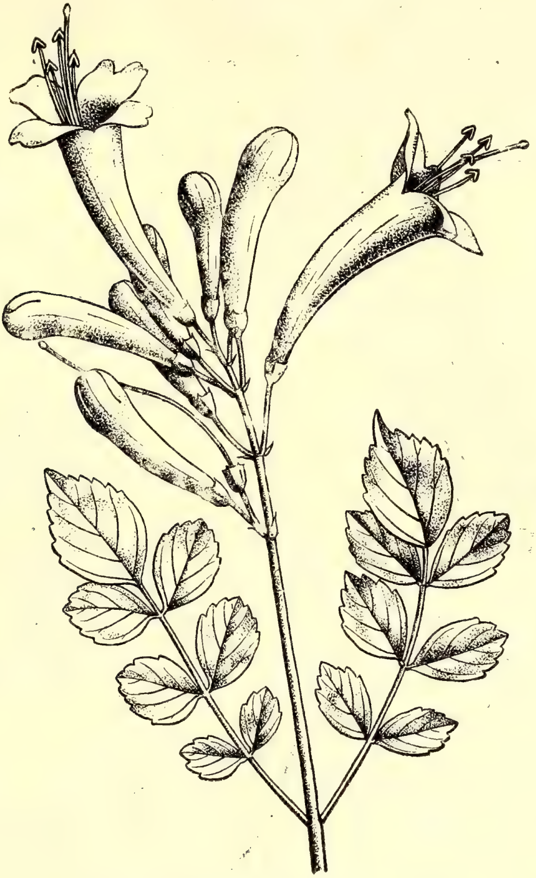

Fig. 2.—*Tecoma capensis* Lindl. ×$\frac{3}{4}$.

Flowers.—Sept.-Oct. *Fruits.*—Cold season.

Distribution.—Indigenous to the Cape, South Africa. Cultivated rather frequently in gardens throughout India.

Gardening.—The Cape-Honeysuckle grows luxuriantly in our gardens. If the long shoots are cut back severely, the plant can easily be trained into shrub form. It is usually propagated by cuttings which strike root readily during the rains. It is rather frost-tender and must be protected from ground frosts.

Tecoma Smithii W. Wats. is supposed to be a hybrid between *T. mollis* H. et B. and *T. capensis* Lindl. It is an upright bush with odd-pinnate leaves of 11-17 leaflets. Flowers in large compound panicles, bright yellow tinged with orange.

Tecoma radicans Juss. [**Campsis radicans** (Linn.) Seem.]. Trumpet-Vine.

(The specific name means 'rooting' in Latin and refers to the aerial roots of this plant).

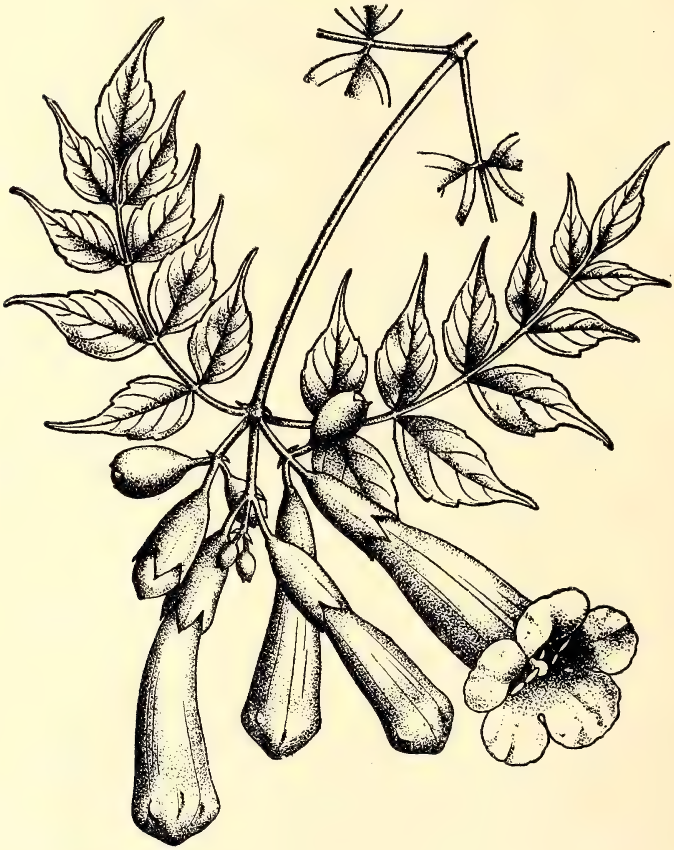

Fig. 3.—*Tecoma radicans* Juss. ×$\frac{3}{4}$.

Description.—An extensive scandent, deciduous shrub climbing by means of adventitious roots. Stems and branches cylindrical, smooth and polished, emitting roots where they touch the soil. Leaves compound, odd-pinnate, opposite; leaflets 9-11, petioled,

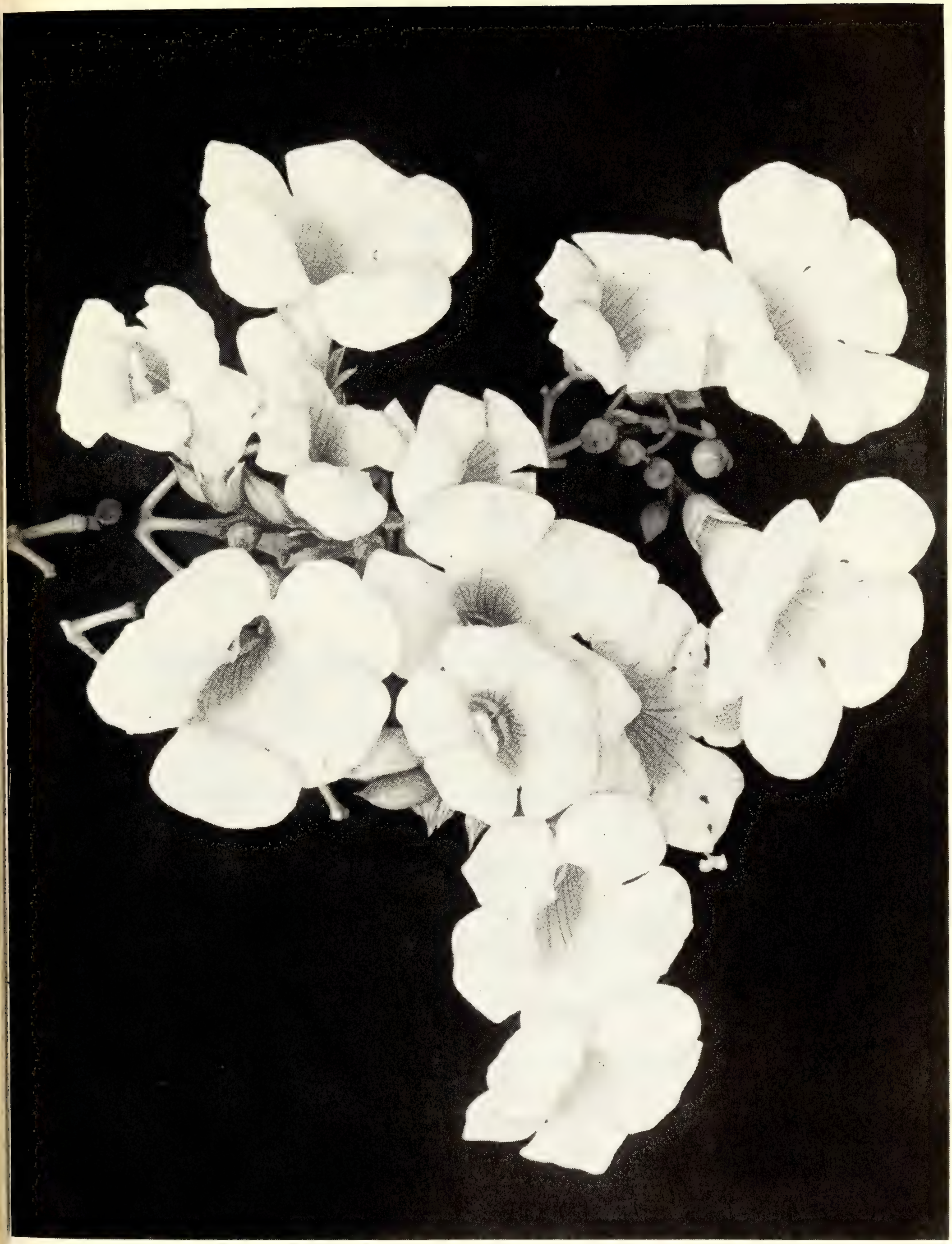

Photo by M. N. Bakshi.

Trumpet-Vine (*Tecoma radicans* Juss).
New Forest, Dehra Dun.

ovate to ovate-oblong in shape, 1.5-2.5 in. long; acuminate or tailed at the apex, coarsely toothed glossy dark green above, paler beneath and hairy at least on the midrib. This shrub is leafless during the cold weather.

Flowers in terminal clusters or panicles. Calyx tubular-campanulate, rather leathery, glandular, shortly 5-lobed, .5-1 in. long. Corolla narrow tubular below, funnel-shaped or campanulate above, about 3 in. long, with 5 spreading lobes which are fimbriate on the margins; slightly 2-lipped, orange in colour with a scarlet limb. Stamens four, inserted on the corolla tube, two long and two short, included within the tube. Ovary oblong, seated in a large disk. Style filiform with two stigmatic plates at the apex. Fruit an elongated, angled capsule, 3-5 in. long, curved and beaked at the apex. Seeds many, compressed, with two large, translucent wings.

Flowers.—Practically throughout the year except the cold weather. *Fruits.*—Cold season.

Distribution.—Indigenous to North America. Commonly cultivated in gardens throughout India.

Gardening.—This species is particularly adapted for covering walls and rocky embankments, as it will climb with aerial rootlets and clings firmly to its support. It is an excellent plant for covering bare trunks of trees. It is constantly in bloom with a profusion of drooping corymbs of orange-scarlet tubular flowers. Usually propagated by cuttings or root-suckers.

Tecoma grandiflora Delaun. [**Campsis grandiflora** (Thunb.) K. Schum.].

Large-flowered *Tecoma*. Chinese Trumpet Creeper.
(‘*grandiflora*’ means large-flowered in Latin).

Description.—An extensive climber with few or no aerial roots. Stems somewhat angled, smooth and glabrous. Leaves opposite, compound, odd pinnate. Leaflets petioled, often unequal-sided at the base, 1-2 in. long, ovate, ovate-oblong or lanceolate in shape, acuminate, coarsely toothed, perfectly glabrous on both surfaces.

Flowers in terminal, pendulous, racemose panicles. Calyx campanulate, divided almost to the middle into five lanceolate lobes which end in a subulate point. Corolla up to 2 in. long, shorter and broader than that of *T. radicans,* scarlet or orange in colour, sometimes showing marked scarlet striations in the throat, terminating in 5 spreading lobes. Stamens four, two long, two short, not exserted from the corolla. Anther-cells divaricate. Ovary seated in a disk. Style filiform. Fruit a capsule, not beaked at the apex.

Flowers.—Hot and rainy season. *Fruits.*—Nov.-Dec.

Distribution.—Indigenous to China and Japan, now widely cultivated in the tropical and subtropical parts of the world.

Gardening.—This graceful climber is very beautiful when in full bloom during the hot and rainy season and is an ornament to any garden. It sheds its leaves in the cold weather, when it is advisable to cut it well back and remove the numerous suckers which it sends up all round from the roots. Easily propagated by root-suckers, cutting and seed.

Tecoma jasminoides Lindl. [**Pandorea jasminoides** (Lindl.) K. Schum.]

The Bower Plant of Australia.

(The specific name means 'jasmine-like' and probably refers to the foliage).

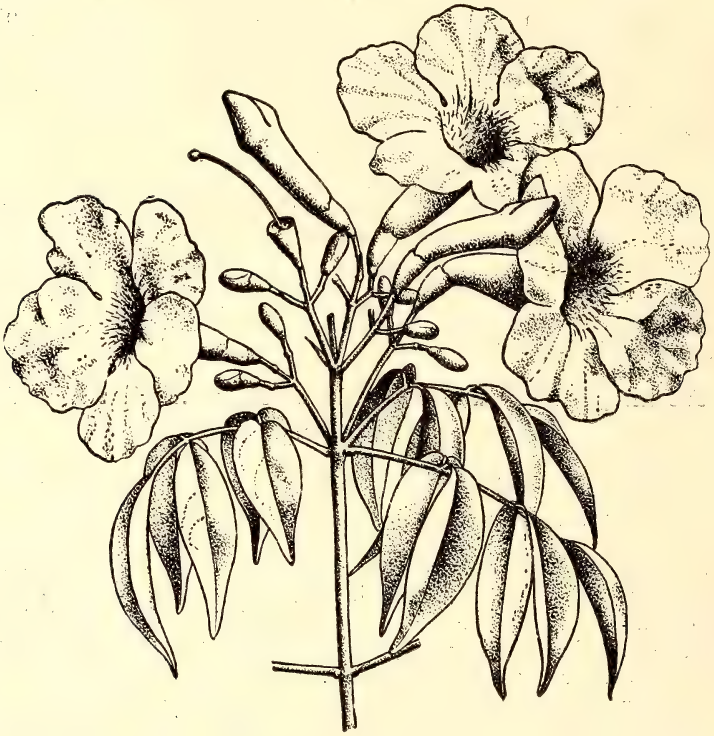

Fig. 4.—*Tecoma jasminoides* Lindl. × $\frac{3}{4}$.

Description.—A climbing shrub. Stems terete. Leaves opposite, compound, odd pinnate. Leaflets 5-9, narrowly elliptic, ovate or lanceolate in shape, sessile, blunt at the tips, quite entire, dark green in colour, glabrous, 1-1.5 in. long.

Flowers in axillary or terminal many-flowered corymbose panicles. Calyx .25 in. long, almost truncate or obscurely lobed, tubular in shape. Corolla tubular, campanulate, expanding into 5, almost orbicular, wavy, lobes white or rosy pink in colour, dark pink or almost purple in the hairy throat, 2 in. wide at the mouth and as long. Stamens four, two long two short; anther cells spreading so that they come to be on the same line. Ovary seated on a ring-like disk. Style filiform, 2-lobed.

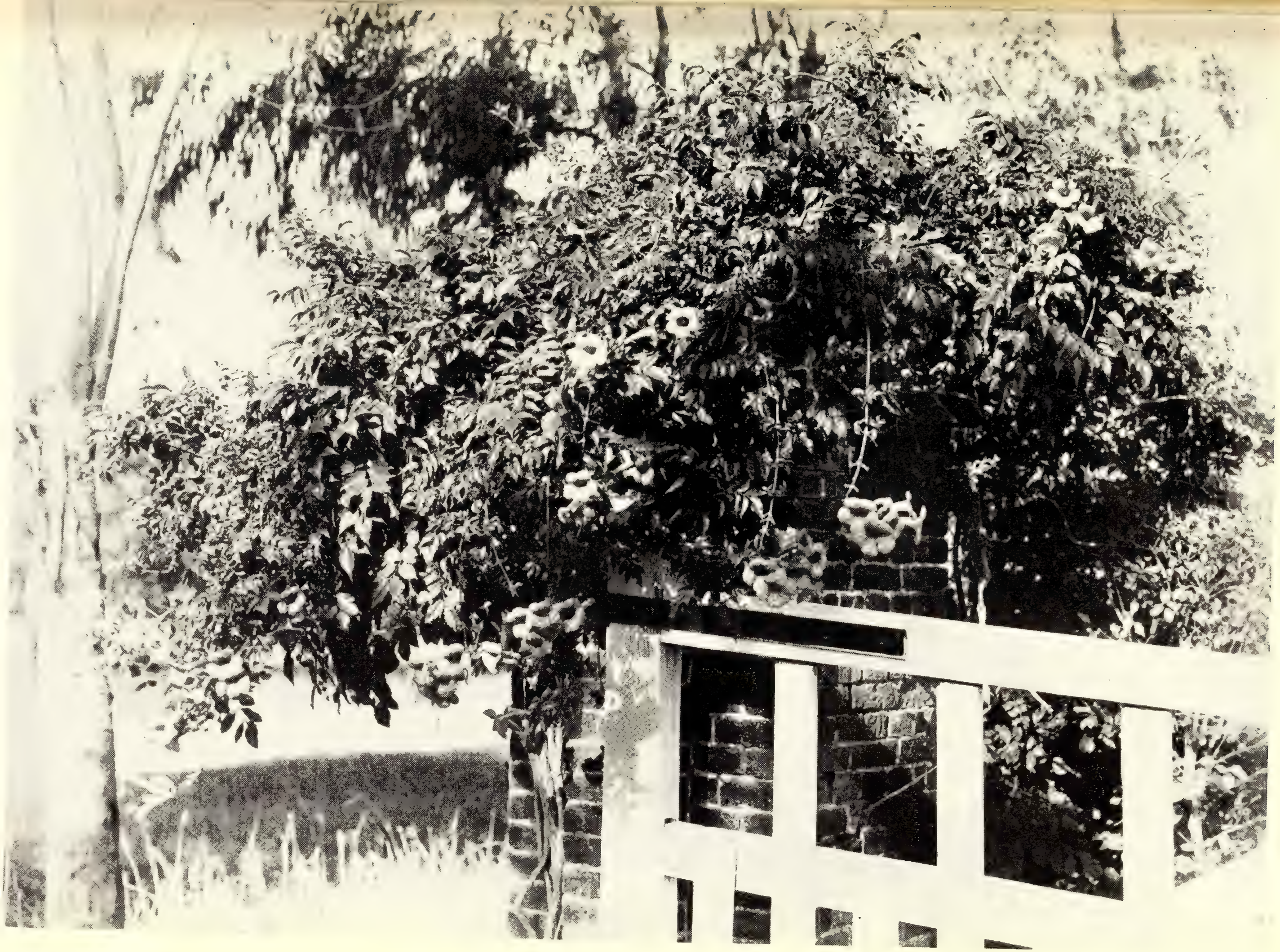

Photo by M. N. Bakshi.

Trumpet-Vine (*Tecoma radicans* Juss).
New Forest, Dehra Dun.

Flowers.—Hot season. Does not fruit in Dehra.

Distribution.—Indigenous to Australia. Commonly cultivated in gardens throughout this country.

Gardening.—This 'Vine' has rather handsome evergreen foliage and beautiful large pink flowers. It is quite frost hardy, but requires a rich soil and a sunny site. Propagated by cuttings during the rains.

Tecoma australis R. Br. [**Pandorea australis** (R. Br.) Spach.]. Wonga-Wonga Vine.

(The specific epithet refers to the country of origin of this plant).

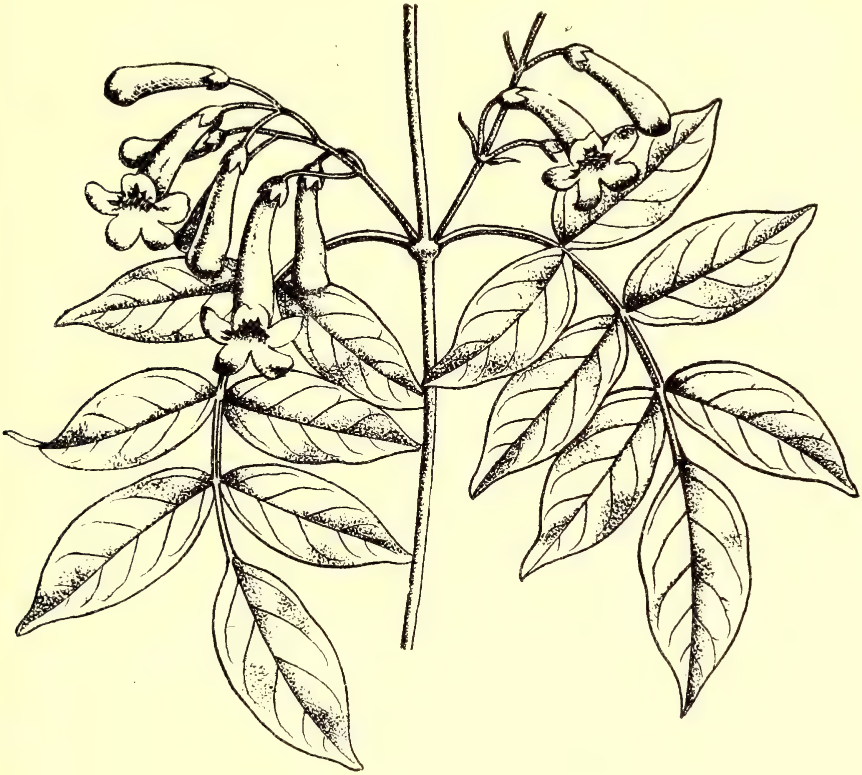

Fig. 5.—*Tecoma australis* R. Br.

Description.—A very extensive climber. Stems cylindrical, striate. Leaves opposite, compound, odd pinnate, exstipulate. Leaflets 3-9, opposite, ovate, elliptic or ovate-lanceolate, almost sessile, perfectly smooth and glabrous, entire or wavy on the margin, glossy green.

Flowers heavily scented, borne in axillary or terminal racemose panicles. Calyx very small, campanulate, regularly 5-lobed, glabrous or slightly hairy. Corolla .5-.75 in. long, funnel-shaped with five short reflexed lobes, yellowish-white in colour, spotted with purple in the throat. Stamens four, included. Ovary seated in a ring-shaped disk. Style filiform, exserted.

Flowers.—March-April. Does not fruit in Dehra.

Distribution.—Indigenous to Australia. Cultivated in gardens throughout India.

Gardening.—This vine has beautiful dark green glossy foliage and comparatively small flowers, but is worth cultivating for its foliage alone. It prefers a soil rich in humus and, if liberally fertilized, it will grow very vigorously. It does not produce fruit in this country, and is propagated by cuttings.

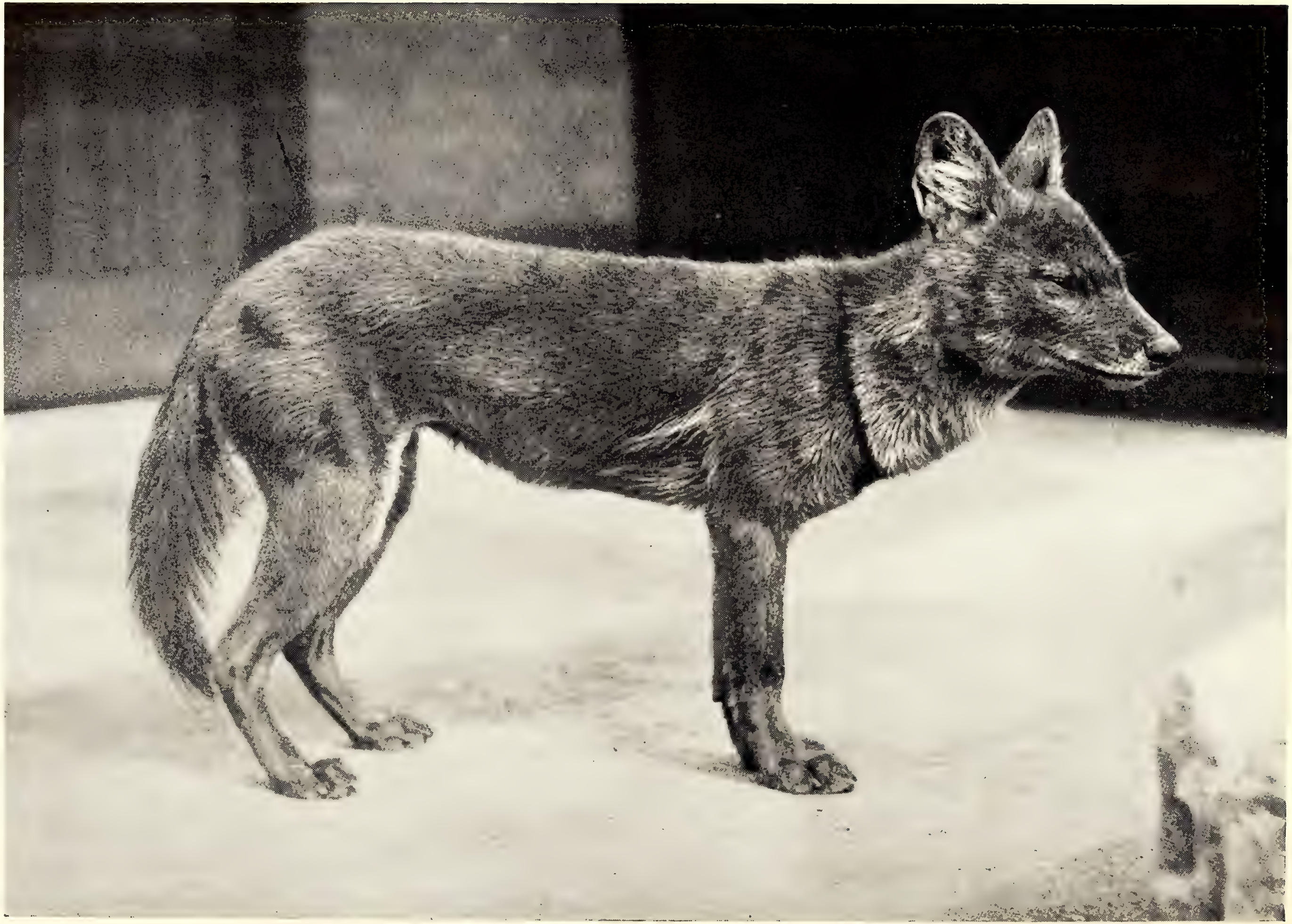

Photo by *F. W. Bond.*

The Asiatic Wild Dog.

THE INDIAN WILD DOG.

BY

LIEUT.-COL. R. W. BURTON.

(*With 3 plates and 1 photo*).

The Journals of the Bombay Natural History Society contain several informative and interesting articles concerning the Wild Dog of India, as also a considerable number of sportsmen's observations embodied in Miscellaneous Notes scattered over a period of many years: and in Mr. A. A. Dunbar Brander's authoritative work 'Wild Animals in Central India', published in 1923, is a chapter on the Wild Dog which is almost exhaustive on the subject.

Former issues of the Journal are, however, not possessed by the majority of present Members, so this article is contributed to collect in one place all information the writer is able to record from the writings of others, and his own knowledge, concerning this interesting animal, and the varieties found in Burma and the adjoining countries.

The Wild Dog is widely distributed throughout the Indian Empire, and most sportsmen have met with the species during their jungle expeditions; but the experience of any individual sportsman is limited, and not all of them have been particularly observant.

Captain Williamson's well-known and sumptuous work was perhaps the first book on the wild sports of India, but is unfortunately not available to me for reference. Dr. Daniel Johnson's *Indian Field Sports in Earlier Days,* which attained a second edition in 1824, followed soon after, and in it he relates that he saw 'Dholes or Quihoes several times and have heard it said that their claws are retractile, if so they may be considered as belonging to the feline species;—and as they are armed with talons they must be very formidable.' So we know the good Doctor was not very strong in Natural History. I cannot trace that word *Quihoe;* it is not in Hobson Johnson.

In a book concerning the game of South India, 'Game' by 'Hawkeye' (Major-General Richard Hamilton), published in 1876, the author says that in former days (the Nilgiris were first 'discovered' in 1818) wild dogs were often met with on the Hills in really formidable numbers, and he himself remembers seeing a very large pack sweeping across the head of the Ootacamund Lake.

> 'People in those days were alarmed at meeting these dogs, under the idea that they were somewhat akin to the wolves of Siberia, and would not scruple to attack and devour unarmed men. Certainly they exhibited little or no fear of man; but sportsmen hesitated to shoot them when in packs under the above impression—that they were liable to attack, and when once their firearms were discharged, they would be at the mercy of the rest, and would probably "sup sorrow".'

In *The Highlands of Central India* (1872) page 343, Captain J. Forsyth mentions a breed of fine, large, red-coloured pariah dogs which was the indigenous dog of the Upper Narbada forest country, and suspected them to be descended from the wild species inhabiting those jungles. The most noticeable distinction between the wild dogs and the tame pariahs was that the former carried their tails never raised higher than the line of the back while the latter raised their tails at times a good deal higher, with something of a curl. Another difference was that the wild dog could not bark. So much did this breed resemble the wild dog that on one occasion Forsyth allowed what afterwards proved to be a wild dog to escape, thinking him to be a strayed red pariah.

It was suggested by Professor H. Littledale in his interesting article (*Journal,* Vol. vii, page 499) that the dental and other characteristics of these should be compared, but there is no record of this having been done. There is reason to believe that this breed still exists, so perhaps some member of our Society can procure skins and skulls for this purpose.

The wild dog and the jackal interbreed on occasion, also the jackal and the pariah dog (Vol. xxx, page 698). A photograph of a wild dog bitch with her two pups, sired by a jackal in the Mysore Zoo in November 1930, is published at page 198 of Vol. xxxv; so there is no reason why breeding between wild dog and pariah dog should not have resulted in a breed of red pariahs.

The true Indian Pariah Dog is mostly red in colour. At page 165 of Vol. xiv is an interesting article by Lieutenant-General Osborn on the sheep and pariah dogs of India. He describes how a single red pariah dog pluckily bayed a wounded man-eating tigress which he would certainly not have been able to kill had it not been for the assistance of this dog. He also relates how a village shikari of Mysore used his red pariah dog to attract ducks within shooting distance of his lake-side pit, just as in some English decoys the well-known habit of wild birds to curiously follow or mob their natural enemy has been used by means of a trained dog of suitable reddish colour to entice wildfowl to captivity. Much has come from the East to the West: perhaps this is an instance. A description is also given of a pack of these red pariahs, owned by Benders of Ramandroog, 40 miles from Bellary, hunting and killing sambhur after the manner of *Cuon.*

At page 709 of Vol. xiii is a very interesting article on the Sheep Dogs of India.

Wolves, jackals, foxes, and domestic dogs are all comprised in the genus *Canis;* Blandford being of opinion that the latter are apparently descendants of several wild forms amongst which the common wolf and the common jackal are the two principal.

An Editor's foot-note to page 699 of Vol. xxx may be here suitably inserted.

'The origin of the domestic dog is still involved in mystery. Some Naturalists believe it to be a distinct species descended from one that no longer exists in a wild state, others trace its ancestors to the wild or half-wild races either of true dogs, wolves, or jackals; while others believe it to be the result of mingling of two or more wild species or races. Blandford is of opinion that the common Indian pie-dogs may be in part descended from wolves; he adds, however, that they are probably derived chiefly from jackals.'

Darwin, discussing The Origin of Species, admits that domestic dogs are descended from several wild species, but remarks that there has been an immense amount of inherited variation. Blandford quotes Darwin's opinion that:—

> 'It is highly probable that the domestic dogs of the world have descended from two good species of wolf (*Canis lupus* and *Canis latrans*), and from several races or species of the jackal.'

The wolf, *Canis lupus,* is of great antiquity, its bones having been found in Post-Pliocene (pre-glacial) deposits of the Quaternary formations of the 'Cromer Forest-bed' together with those of various extinct mammals. It is quite possible that some of the world's domestic breeds are descended from wild species long since extinct.

The genus *Cuon,* to which the Asiatic Wild Dog (*Cuon javanicus*) belongs, is distinguished from the genus *Canis* by the more rounded ears and proportionately shorter muzzle; by the line of the face viewed sideways being slightly convex, that of *Canis* being straight or concave, and by having only two true molars on each side of the lower jaw instead of three. The mammae are more numerous, there being usually 6 or 7 pairs instead of 5 typical in *Canis.* Blandford mentions the long hair between the foot-pads, but this is not unusual in many species of *Canis.* In other respects *Cuon* agrees generally with *Canis.*

A LARGER AND A SMALLER SPECIES.

In his interesting article (Vol. vii) Professor Littledale touches upon the remark of Jerdon (Mammals of India, 1867, page 145), also mentioned by Sterndale, that it has been supposed there is more than one species of wild dog to be found in India. There has been in earlier days a belief prevalent among sportsmen of the existence of two races. Colonel A. E. Ward's *Sportsmen's Guide to Kashmir,* page 88, is cited as recording the assertion of Kashmir native shikaris that there are two species, the smaller breed destroying sheep and goats and keeping low down in the ravines, the larger hunting in the higher mountains.

This belief in a larger and a smaller breed is prevalent even in the present day in the jungles to the north of the Nilgiri Hills and along the Mysore border. At page 516 of Vol. xxxi an Editor's Note mentions the same belief being held by the Nagas of the Mishmi Hills.

Mr. R. C. Morris mentions the matter at page 491 of Vol. xxxvi, referring to the possibility stated by A. J. W. Milroy, Conservator of Forests, of there being two kinds of wild dog in Assam, a larger species hunting in pairs and a smaller type hunting in packs. He (Morris) 'has noticed that wild dogs often hunt in pairs, and these appear to be considerably larger than even the leaders of dogs hunting in packs'. In the Central Provinces one sees these pairs of dogs, as also all sizes of dogs in packs.

Mr. L. E. C. Hurst (C.P.) tells me he has only seen these pairs in the breeding season, say November to March, and not at other times of the year.

The present writer has observed that wild dogs of the Siwaliks and Doon Valley appear to be larger animals and of a brighter red than those of the Central Provinces and South India, but obtained no specimens.

Professor Littledale's suggestion that the small breed is really a pack of females and young dogs is no doubt the correct answer to this question. Had there been a larger and a smaller species in India the inevitable interbreeding would have merged the two races long ago.

SPECIES AND RACES OF THE WILD DOG.

The Asiatic Wild Dog has a wide habitat. Pocock (P. Z. S., 1936, p. 34) gives its distribution as ranging from 'Saghalien, Amurland and the Altai Mountains, about lat. 50° N., over the whole of continental Asia, roughly east of Long. 70° E., and occurring in the Islands of Sumatra and Java, but not in Japan, Ceylon[1] or Borneo'. Within this wide range the older Zoologists claimed to recognise two or even three distinct species. Blanford recognised a northern and central Asiatic species under the name *C. alpinus,* an Indian species, *C. dukhunensis* and a Malayan species which he called *C. rutilans.* Pocock (loc. cit.) having at his disposal the great mass of material made available in recent years, concludes that in all Asia there is a single species of Wild Dog, to which he assigns the name *Cuon javanicus; javanicus* is the name first applied to any form of *Cuon,* and it therefore antedates *dukhunensis* by which our Wild Dog has become more generally known. Pocock recognises a number of local races. The form found in the Indian Peninsula, south of the Ganges, and also in Assam, he names *Cuon javanicus dukhunensis* Sykes, distinguishing it by its larger skull from the typical Javan Wild Dog (*C. j. javanicus*) and from *C. j. sumatrensis,* found in Sumatra and the Malay Peninsula, by its longer, fuller coat, yellower, less vividly red-colouring and again by its larger skull. The race found in the Central and Eastern Himalayas through Kumaon, Nepal and Sikkim is *Cuon j. primaevus.* Pocock distinguishes this race from the Peninsular form as being on the average redder in hue, fuller in winter coat, more amply provided with under wool and more hairy-soled. These distinctive characters he states are evident from puppyhood. The Wild Dog of Kashmir is recognised as a separate race to which the name *C. j. laniger* is assigned. Pocock distinguishes the Kashmiri from the Central and Eastern Himalayan Wild Dog by its much fuller, softer coat and much paler colouring. No material is yet available to establish the identity of the Wild Dogs of Burma, though Pocock has described a new race from Moulmein for which the distribution given is 'North Tenasserim and possibly Annam'. To this form he gives the name *C. j. infuscus,* distinguishing it from the *javanicus* and *sumatrensis* mainly by cranial characters.

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[1] The wild dog is not found in Ceylon, where the jackal takes its place, and is occasionally known as a hunter and destroyer of hinds and fawns, but not to anything approaching the terrible efficiency of *Cuon.* The Ceylon jackal (*Canis lanka*) seemed to me a larger animal than *C. aureus.* It would be interesting to have a series of weights and measurements of both species.

Mr. W. W. A. Phillips gives me measurements of Ceylon Jackals as under:

Male—one only—head and body 30·5 in., tail 9·5 in., hind foot 5·3 in., ear 2·9 in., weight about 20 lbs.

Female—average of four—head and body 27·1 in., tail 7·9 in., hind foot 5·3 in., ear 2·9 in., weight 14¾ lbs.

Maximum females—27·4 in head and body, 8·97 in. tail, 5·3 in. hind foot, 3 in. ear, 18 lbs. weight.

THE INDIAN WILD DOG.

Colouration.

From time to time sportsmen bring to notice variations in colour and in size. These can safely be said to be caused by environment, more or less abundant food supply, and climatic differences in various parts of the extensive region inhabited by this widely distributed animal.

Blandford describes the colour of *C. j. dukhunensis* as follows:

> 'On upper parts generally rusty-red, varying in some specimens to rufous gray or even light brownish gray, paler below. The colour is generally not uniform, being variegated by dark tips to the dorsal hair. The under-fur, when present, varies in colour from light brown to dull rufous on the upper parts, and has light coloured coarser hairs intermixed; the longer hairs are light rufous, with dark rusty-red tips. The terminal portions of tail black (very rarely the extreme end is whitish). The young animals are sooty brown throughout.'

Dunbar Brander's description is:

> 'Uniform red, shading into yellow or dirty white on the belly. The points of the hairs along the dorsal ridge are often black. The ears, which are pricked, are frequently pointed black. The tail, which is short (about 8 inches) has a bushy tuft of black hair some 5 in. or 6 in. long at the end. There are generally a few gray hairs in the middle of this black tuft, and it is not uncommon for these hairs to be sufficiently numerous to amount to a small white tuft within the larger black tuft.'

He adds, differing from Blandford as far as the wild dog of Central India is concerned, that the existence of the white tip is much more common than the black tip.

In an Editor's foot-note at page 516 of Vol. xxxi it is remarked:

> 'In colouring the wild dog varies from uniform red to rufous gray or even light brownish gray. As regards the colouration of the terminal portion of the tail, — of a series of thirty-four skins obtained in India and Burma all except four have black tips to the tail, including specimens from South India and Canara — of ten specimens in the Society's collection obtained in the Berars and C. P. seven have black tips and three white.'

There are often white hairs at the end of the tail not visible unless the longer black hairs are parted. At page 590 of Vol. xxxii it is recorded that three three-quarter grown specimens shot from the same pack (U.P.) had: one a black tail tip, one a few white hairs, and the third a distinct white tip to the tail like that of the Silver Fox.

Mr. R. C. Morris notes that wild dogs, when killed, seem to lose immediately the 'gloss' of their coats: so also with Hyænas.

Melanism.

This appears to be uncommon: only two instances are recorded, and one of these is not very reliable. At page 813 of Vol. xxxviii R. C. Morris reports that Mr. V. G. Darrington, D.F.O. of North Coimbatore, saw on the 11th January 1936 near Geddesal a wild dog which was wholly black with the exception of a white tip to its tail. I was at Geddesal at the end of January that year and saw wild dogs but did not, unfortunately, come across the black one.

At page 215 of Vol. xx it is reported by Major H. W. Berthon that his men saw 7 or 8 wild dogs of which one was *'bilkul kala'* (wholly black); there was a great variety of colouring and one of the animals shot proved to be a jackal.

Mr. S. D'Arcy McArthy tells me he saw a wild dog in the U. P. with a white patch extending from the neck down the shoulder. It was not shot.

No instance of melanism can be found in any book seen by me.

Weights and Measurements.

Recorded weights and measurements of *Cuon* of both species are scanty, and it is suggested that sportsmen should make a point of recording all they can from all parts of India and Burma for communication to the Society. Those to be found in the Journal and other publications are tabulated below:

Vol. vii p. 503.	Head and body	34 in.	Tail with hair	17 in.	Height	20 in.
Vol. x p. 449.	Do.	35 in.	Do.	17 in.	Do.	19½ in.
Vol. xiii p. 529.	Do.	34½ in.	Do.	17 in.	Do.	21½ in.
Do. p 529.	Do.	34½ in.	Do.	17 in.	Do.	18½ in.

All the above females.

Vol. xxxii p. 714. Do. 38 in. Tail 14 in. weight 28 to 32 lbs.

This is from Kashmir and gives average measurements.

Major E. G. Phythian-Adams (Nilgiris).

Male 36 in. head and body, tail without hair 12 in., height 18 in., girth 21 in., neck 12½ in.

Male 36 in. head and body, tail without hair 13 in., height 20 in., girth 20 in., neck 12 in.

Game-Book for Burma. length 48 to 54 in. of which tail rather more than a foot long; weight 35 to 40 lbs. *Cuon rutilans.*

Blandford's measurements are obviously unreliable and are not here given.

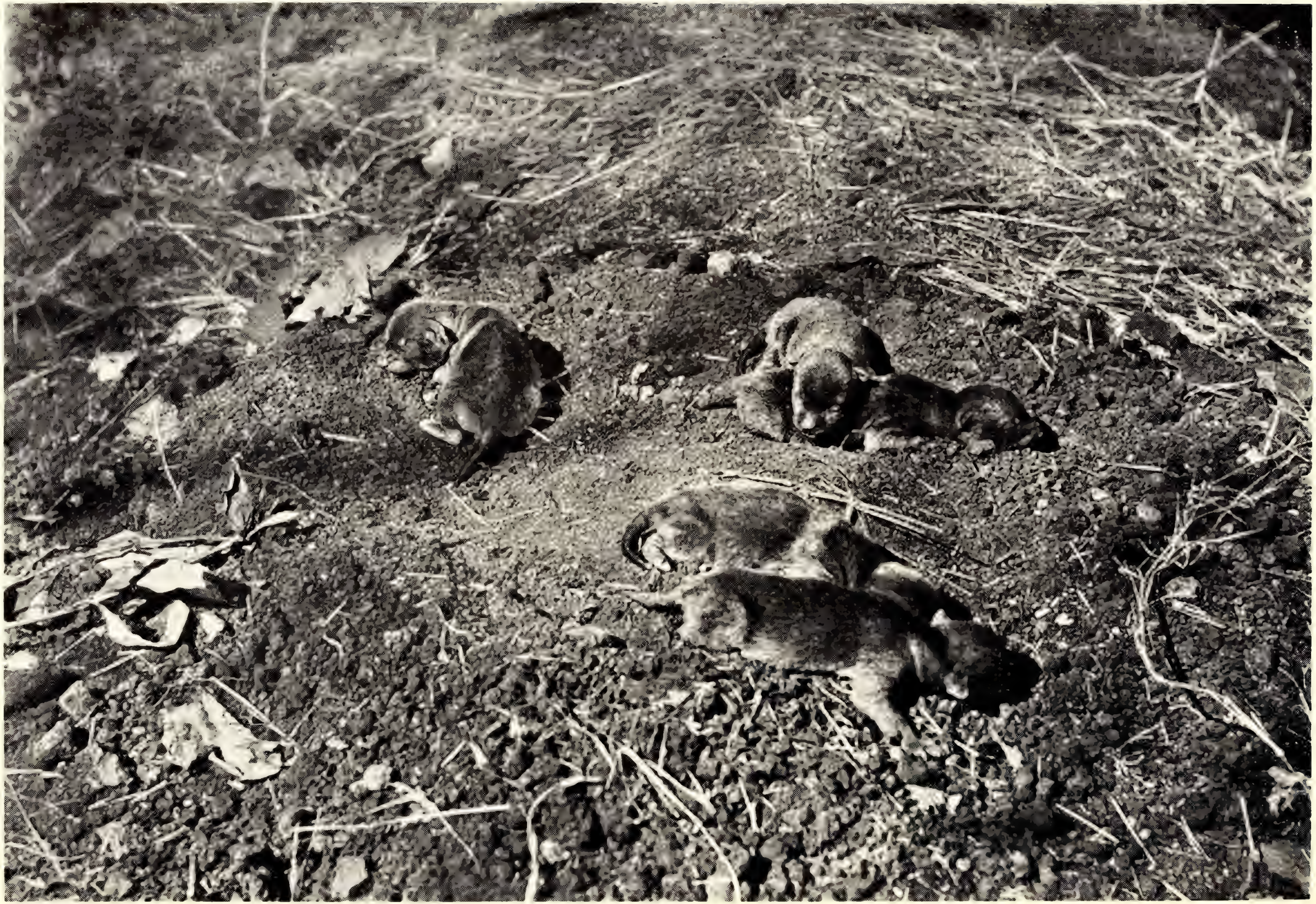
Sterndale and Jerdon: Head and body 32 to 36 in., tail 16 in., height 17 to 20 in.

Dunbar Brander M....22 in. at shoulder, weight 43 lbs.
F....half an inch shorter and 5 lbs. lighter.

It is apparent how many more data are needed.

Breeding, Taming, Characteristics, and Disposition.

As already mentioned the mammæ may number as many as sixteen. Most writers say fourteen. Eight pairs are mentioned by Pocock at page 851 of Vol. xxxix. The mammæ are not



From a photograph by J. D. Inverarity.

Wild Dog Puppies.

necessarily in even numbers on either side. On page 449 of Vol. x, eight one side and six other side are mentioned as having been counted by Mr. Inverarity.

The number of young at a birth may vary from two to six or more. In 'Robin Hood's' article (Vol. x, p. 127) six puppies are instanced. At p. 442 of Vol. xxxv litters of seven and ten are mentioned by me, also a case of seven embryos being taken from a shot animal. Major Phythian-Adams tells me that he himself took nine embryos from a wild dog shot by him on the Nilgiri Hills; and his chauffeur took seven pups from an earth where there was a bitch from the pack on guard. At this place a number of the dogs were breeding; there were many earths; a regular pack nursery! Such places are not uncommon: I recollect one in the Biba shooting block, C. P., where there were several earths—crevices in rocks in a nala bed.

At page 529 of Vol. xiii is an excellent photograph by Inverarity, reproduced here, of five wild dog puppies lying outside the earth from which they were taken on the 27th December in Gugamul Block, Melghat Forests, C. P.

> 'The puppies (three males and two females) were at least a week old. Three had ticks on them. They were a uniform dark brown colour, slightly yellow about the neck, and were exactly like pointer puppies, as will be seen from the photograph'.

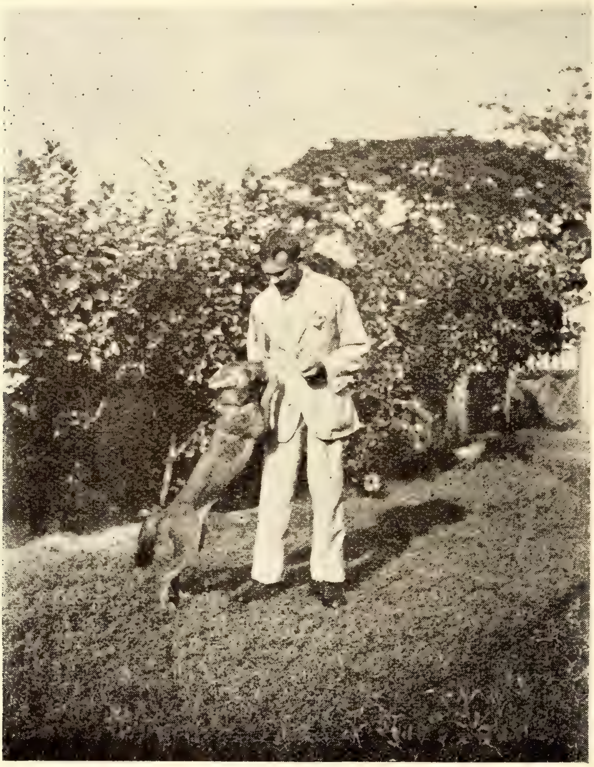
'Robin Hood', Vol. x, p. 127, described his six puppies as 'six lovely little russet-red balls of fur'.

> They were reared by a village pie. The first pie, which had five pups of her own, was so horrified at their odour that she would have none of them. The second pie, with three pups, after a great deal of trouble, became as attached to the jungle puppies as to her own. This was no doubt due to the fact that, in the course of a week or so, her own puppies got to smell as badly as their jungle confrères. At a very early age the jungle puppies evinced an incorrigibly pugnacious disposition, and fought with appalling ferocity. It was incredible to see such small things fighting with so much resolution and tenacity. If the uppermost belligerent were lifted by the tail to the height of one's head it would carry its opponent up with it, and the latter would likewise decline to relinquish its hold. They would fight in this way day after day, the sluts being quite as tenacious as the dog puppies. The unfortunate pie-pups must have wondered into what company they had fallen. They would yell piteously when the wild foster brethren shook them up, and we were obliged to send them away when quite small to prevent them getting killed. Meanwhile the wild pups continued to fight with each other with unabated ferocity until they were about seven or eight months old when—most singular to relate, they put a permanent period to their hostilities and lived in perfect amity. Apparently they had decided which was the strongest amongst them, as they paid marked deference to one large dog—the largest among them—who acted as their leader. They never fought with each other after they became adults. The big dog above referred to had a white spot on the near forepaw and the extreme end of his tail was tipped with white. This was observable only on a close and critical scrutiny. The other dogs were similarly marked; the remaining three were entirely russet-red. They all had large prick ears (which they laid back flat like a vicious horse when angry or attacking), and long, heavy, bushy tails. They would eat nothing but raw meat. We nearly starved them to death in the endeavour to make them eat cooked food, but without avail. They would eat nothing but flesh, and not that unless it was raw. They would not eat stale meat. . . The dogs were dangerous to approach when feeding; but could be handled at any other time.

They would never molest men; but would 'go' for any and every animal. In consequence they had to be kept on the chain. When they broke loose, which not infrequently happened, they did not attempt to escape, but always kept about the house. They all met untimely deaths. One died while still a pup from confinement in a basket—they appear to require plenty of fresh air—another died while *en route* to a railway station; and the remaining four from diarrhoea engendered by a cannibal propensity they had of killing and eating any stray dog they could get hold of.

My observation of these dogs has convinced me that for gameness, staunchness, and invincible tenacity we have no breed of domestic dog to compare with them.'

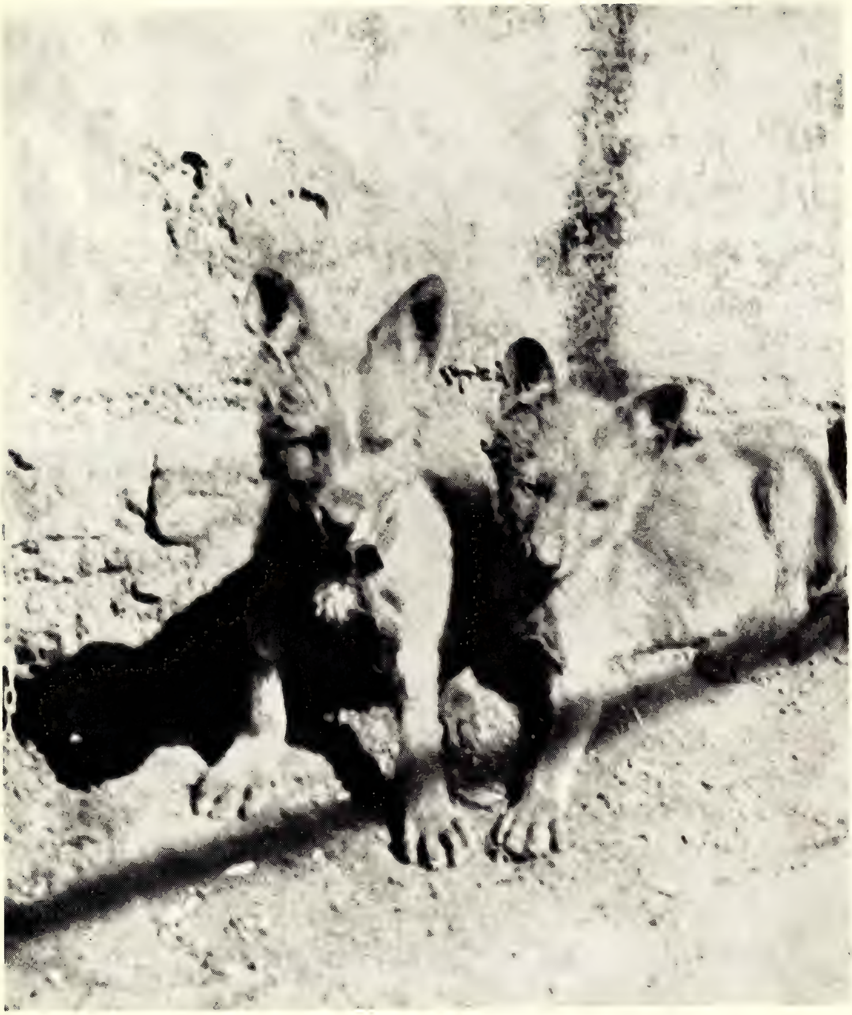
Major Phythian-Adams tells me that the above exactly corresponds with his own observations of wild dog puppies kept by him.



M. Charles Theobald's Wild Dog.

The wild dog can be tamed, but has to be taken in hand when very young. Here is a photograph of one of a pair possessed by Mr. Charles Theobald of Mysore for about two years.

'This pair were not related, having been captured in the forest in different localities. and were about a month old when I got them. At first they had the strong smell characteristic of most wild dogs, but this wore away with regular baths, and then they smelt the same as domestic dogs. Both matured in about a year, and were mated. One pup was born in November but was accidentally bitten by the mother at time of birth, and died.



Indian Wild Dog Puppies.

Although the dogs were quite tame they were difficult to manage and were not savage. No strangers could go near them. The period of gestation was about the same as that of the domestic dog. The noise the dogs made most was the usual soft whistling one to call to each other, or to me. They would come to me when called. When distressed they would whine, and utter a suppressed bark when angry.

When excited they wet themselves, and the urine would be splashed about by whisking tails. The urine had no bad effect on human eyes. That was a personal experience.

They were fed with milk in the mornings, raw meat in the day, and ordinary dog's food in the evenings. Sheep's leg with hair on was regularly supplied. Food was digested and passed in about twenty four hours.

As to the last sentence it is probable that, in a wild state, food is passed in a shorter time than this. Phythian-Adams' pups were fed much as above.

It will be noticed that this feeding experience differs from that of 'Robin Hood'. It is a pity that the gestation period was not exactly noted, as there appears to be nowhere any record of this.

Here is a photograph of two wild dog puppies possessed for a short time by Major Phythian-Adams. At time of photo they were about two months old and did not live long after that.

It may be noted here that until the young ones are able to leave the place where born they are fed by partially digested meat vomited by the mother. Breeding season is from November to February.

Popular names.

To the sportsman and the general public *Cuon* will always be known as 'Wild Dog' although, as Blandford says, the name is clearly a misnomer; for in every important detail in which the genus *Cuon* differs from *Canis*—form of skull, dentition, number of mammæ—domestic dogs agree with the latter and not with the former.

Vernacular names.[1]

Assamese	Kuang-kukur or Rang-kukur.
Bengali.	Ban Kutta or Ban-kukur.
Bhil.	
Bhutanese.	Phara.
Burmese.	Tan-kwe.
Canarese.	Ken-nai, chen-nai.
Chenchu.	Reis-kukul.
Chin.	Nyar.
Gond.	Nerka.
Gujrati.	Eram-naiko.
Ghurkali.	Ban-kukur.
Hindi.	Adivi-kuta, Son-kuta, Sona-kuta, Rasa-kuta.
Hindustani.	Jungli-kuta, Ram-kuta, Ban-kuta.
Javanese.	

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[1] I am indebted to Mr. C. G. Mackarness, Senior Conservator of Forests, Assam, Mr. W. Meiklejohn, Senior Conservator of Forests, Bengal, and Mr. F. W. Champion, Conservator of Forests, Western Circle, U.P., and to Mr. F. J. Musthill, Game Warden, Burma for assistance in compiling this list. Will members able to add to the list of local names, kindly communicate with the Hony. Secretary.

Kachin.	Kyi-kwa-lam.
Kashmiri.	Jungli-kuta, Ram-hun, Bȃn-kuta. Bhansa (E. Himalaya).
Khond.	
Korku.	Bun-seeta.
Lepcha	Sa-tun.
Mahratti.	Hahmasai-kuta, Kolsun, Kolsa, Kolasri.
Malayalam.	Shen-nai.
Nepali.	Bwaso.
Malay.	Sirgala, Arjing-kutar.
Punjabi.	
Shan.	
Tibetan-Hazi.	Phara.
Siamese.	
Tamil.	Chen-nai.
Telugu.	Vanna-kooka.

Odour.

Blandford remarks that the strong and unpleasant odour of *Cuon* resembles that of the jackal, this being due, in part, to secretion from the anal glands. But this is not always the case, as some observers have described the wild dog as having the exact smell of the domestic dog; e.g., Inverarity, who was an experienced and reliable sportsman, at page 394 of Vol. viii relates having shot one of a pack. 'It was a female and had the exact smell of a domestic dog.' See also Mr. Theobald's notes.

Voice.

The difficulty in describing the various voice sounds of the wild dog is apparent from the writings of naturalists and sportsmen. The word *bark* has been used but does not convey a correct impression. Voice noises *growl, snarl, whine,* are almost the same as those of the domestic dog. The mate call mentioned by Dunbar Brander I have, unfortunately, not heard. The sound uttered when startled, alarmed, or at time of disputing a tiger or panther kill, as I have myself heard, is a sort of hyæna-like chattering— 'analogous to the 'chuck, chuck, chuck' of the Indian fox.' (Dunbar Brander).

The sound used when the dogs are communicating to one another otherwise than when hunting is difficult to express. A sort of soft whistling noise seems best to describe it. 'Their usual call is a highly pitched whine'. (Best).

Other noises described are: 'A weird bewildering noise—such as I had never before heard in the jungles—' described afterwards by a friend who was with him at the time as 'a kind of fiendish hysterical yapping, in a shrill chorus, decidedly uncanny and all-pervading.' This was when Professor Littledale's terriers rushed into bamboo cover near his camp in the Central Provinces. The hunting notes are variously described. 'Hawkeye' mentions 'a tremulous whimper'. Havelock 'a whistling howl when running to view'. Inverarity saw two dogs, which hunted a sambhur hind and fawn into a fast-running shallow stream, halt at the water's edge and utter 'loud wailing howls'; these, until they reached the water, and on another occasion a pack also, ran mute. I have seen dogs running mute several times and think that when first on the trail they run mute, when the scent tells them they are nearing the quarry they whimper, and when they run to view, or are closing on the quarry, they break into what has been called 'full cry': this is not the music of foxhounds but 'an indescribable howl'. The above is not always the case. The hunting cries have also been described as a 'sort of yapping bark'; this in Nepal. Major Manners Smith could not say they were 'in full cry' but they were evidently hunting, probably *thar* or barking deer. In Burma Mr. C. E. Milner one night in Tharrawaddy heard a pack 'in full cry, rather like a poor-voiced pack of hounds.'

Whistle, whine, whimper, yap, are voice noises mentioned by Major Phythian-Adams, who has never heard them 'bark', as they are said to do by 'Hawkeye'. Best also uses this word, but it is not the bark of a domestic dog: a more hoarse sound. Colonel A. E. Ward writes 'when running by scent they only whimper, but when the prey is in sight and at hand they often break into an indescribable howl'. A night hunt in Nimar is described as 'frenzied whimpering cry'. Mr. La Personne writes of wild dogs hunting at night as 'baying' but that would not, I think, convey a correct impression.

The Indian Wild Dog does not *bark*: domestic dogs turned loose on the island of Juan Fernandez quite lost their bark after 33 years. (Sterndale).

Calling up.

Major Phythian-Adams informs me that wild dogs can be successfully called up by a series of 3 toots' on an empty ·318 cartridge case, these representing the three whistling notes of the dogs calling to one another. This method is best employed after one of a number has been shot; but will also call up from near-by cover a single dog, or one of a pair, which has been seen. Another method found successful is the use of a leaf blown upon edgeways between the thumbs, as employed in Burma for barking deer. It is useful when no shot has been fired. This leaf noise has been mentioned by writers in the *Journal,* and is known to many sportsmen. It is mentioned by Dunbar Brander.

Best (Indian Shikar Notes) describes a similar leaf noise used by him with great success. R. C. Morris describes their calls to each other as a shrill 'ow, ow, ow', the noise being similar to that produced by blowing into a medium bore cartridge case, as described by Phythian-Adams.

Blinding eyes of animals with urine.

Most writers remark upon the belief held by jungle inhabitants of all parts of India where *Cuon* is found that the animal deliberately makes use of its urine to blind game being hunted, either by sprinkling bushes with it and then driving the animals through them, or whisking it into the animal's eyes with their tails. This belief, which will probably never be relinquished by the jungle inhabitants of India and other Eastern countries, is mentioned by Dr. John Fryer in very early days; also in Williamson's 'Oriental Field Sports'. Blandford remarks that a somewhat similar belief is held as to wolves in parts of Europe.

Although we know much of wild life lore of jungle peoples is accurate, or has a substratum of fact, yet in this matter it can be safely asserted that the wild dog's urine has no special blinding property, and that the animal does not deliberately use its urine as an aid to hunting.

Likes and dislikes as to meat.

In his *Game-Book for Burma* Mr. Peacock rightly states that wild dogs generally demolish their kill at one sitting, but adds that they desert their kills, if any meat is left, at the first sign of decay: also that he has not known or heard of their touching carrion, though it is likely enough they may do so when very hungry. Dunbar Brander remarks that high or contaminated meat is distasteful to them and their kills are therefore nearly always finished off by vultures.

It is within my own experience on several occasions, and that of other sportsmen, that wild dogs will appropriate a tiger or panther kill should they come across it. No doubt they prefer fresh meat—that of animals they have themselves hunted, but they do not refuse meals accidentally found. In the C. P. a large pack demolished the carcase of a skinned tigress thrown outside my camp. R. C. Morris notes that he has personal experience of at least a dozen *stale kills* being eaten by wild dogs in the Billigirirangam Hills of South India, and the North Coimbatore forests adjacent to them.

The following note shows that they will sometimes eat very foul and disgusting meat, but it is perhaps a rather exceptional case. R. C. Morris' Note dated 6-2-1937 at page 615 of Vol. xxxix may be quoted in full:—

> 'I recently shot two wild dogs, a male and a bitch, which were as badly affected with mange as I have seen on any pie-dog. The dogs were feeding ravenously on a three-days-old tiger kill and seemed to be quite active. With the exception of the head, which was blotchy, and the ridge of the back the dogs were almost devoid of hair including the tail. The short pig-like tail, free of the brush or hair, and the pink and mangy flesh appearance of the flanks and stomach gave the dogs quite a revolting appearance.'

Peacock also writes that he has never known his tiger or panther baits to be found or killed by wild dogs. This is contrary to the experience of sportsmen in India, more particularly in the Central Provinces, where it is no uncommon occurrence for tethered baits to be killed by wild dogs.

Domestic stock.

Wild dogs do not ordinarily attack herds of cattle grazing in the forests, though there have been a few instances of the kind recorded. The Author of 'Nilgiri Sporting Reminiscences' (1880) writes that:—'......they make frequent attacks upon the Badaga's buffalo calves, and the ryot's sheep and cattle of the low countries. A pack of fourteen or fifteen wild dogs, about five years ago, committed a raid upon a herd of about thirty calves whilst out grazing, belonging to the Westbury Estate, Segoor, and killed five and wounded two of them which died some days after; before I could get with my guns to the spot they had been scared away.'

Such an affair as the above is exceptional, but Phythian-Adams tells me that he knows several cases of buffalo calves being killed out of Badaga herds near Anaikutti: and R. C. Morris notes to me that under certain conditions, in the absence of game animals, it is within his experience that wild dogs will stay in a locality and kill cattle. They did not kill cattle all the time, but did so in the dry weather when the sambhur were noticeably scarce. He adds that some years ago there were a large number of pig in those hills (Billigirirangans): wild dogs then increased and killed scores of pig; since then pig have become quite scarce.

In the other parts of India they occasionally kill single cattle and goats, but it is not a common occurrence. In Kashmir they often worry sheep in the open country'. (Ward).

R. C. Morris sends me the following interesting note:—

> 'Wild dog, a large pack, killed 25 calves here in one year, including six in a go, that were grazing together. This occurred at the time when wild dog were numerous. Stray mature cattle were also killed and devoured; so much so that the Badaga herdsmen at Bellaji (where you camped once) asked me for poison. I gave them 'Atlas' with instructions to dilute with two parts of water. This the herdsmen did not do, but used the neat poison on a freshly killed carcase, and then retired to watch events. The dogs returned and completed their meal, but were soon lying around in great distress. The Badagas told me that there were about twenty in the pack, and as the reward for wild dog is Rs. 10 per head in Kollegal and North Coimbatore they were delighted at the prospect of earning Rs. 200 by the poisoning of the whole pack. To their consternation however the dogs, one by one, commenced to vomit up what they had eaten, and eventually made off. Before this they could have been clubbed to death easily, apparently, but the Badagas were afraid to approach the pack. I was away at the time. This had the effect of curing the dogs' desire for beef for some time.'

It is curious that wild dogs do not molest bullocks in a cart, or attack a pony ridden past a pack lying about by the side of a forest road. Postal runners, frequently killed by tiger or panther in certain parts of India, are never killed by wild dogs. It is fortunate indeed that they have a non-hostile disposition to man and, mostly, to domestic animals.

Game Animals.

Wild dogs kill a great many game animals, as also wild pig. To their diminishing the stock of the latter there is no objection, for these do much damage to cultivation; but their ravages among game animals are often very serious. With the exception of fairly mature bison and buffalo they kill almost all forest animals.

It is fortunate that they do not kill, as does the Dingo of Australia, for the sake of killing, but only when hungry. An instance illustrating this is noted to me by Mr. R. C. Morris who, with Mr. C. W. G. Morris, saw a pack of wild dogs, obviously well-fed, lying about on a grass hill-top while sambhur walked, tails stiffly erect, right up to them. Apart from eyeing the deer lazily the dogs did not stir. After a few minutes the sambhur trotted off for a short distance and then commenced to graze! Some time later the dogs moved off slowly in the opposite direction.

On the Nīlgiris Plateau the wild dogs kill black monkeys which probably leave the safety of trees and race across the open slopes. (Phythian-Adams).

At page 165, Vol. xli, Mr. Dunbar Brander comments upon the extraordinary behaviour of monkeys when attacked by leopards and by dogs (presumably domestic dogs), having known them to abandon the safety of the tree-tops and take to earth to their destruction, and remarks 'In this respect an animal which must be considered as intelligent, behaves like an imbecile.'

I, also, have observed similar instances, but have noticed that it was on seeing the human being the monkeys, or lungoors, vacated their arboreal safety; and the same has been the experience of friends with whom I am staying near the Periyar Lake, Travancore, at time of writing. I have known, on a moonlight night, a pair of panthers acting in concert chase lungoors out of a tree: this being no doubt a normal method of hunting these creatures to their destruction.

That the imbecility remarked upon by Mr. Dunbar Brander is not confined to the lower species of Primates is instanced by the fact that a woman of the Kumaon Hills—sister of the village shikari employed by me in 1924 during pursuit of a man-eating tiger—was killed by the tiger because, when in the safety of a tree gathering oak leaves for cattle fodder, other women being in adjacent trees, and the tiger came under her tree, she cried out 'The tiger has got me! The tiger has got me!' and fell from her secure perch into the animal's jaws!

A week or so previously her aunt had been taken by this tiger when similarly gathering leaves, but was stalked while on the ground.

It would seem that black monkeys of the Nilgiri sholas are frightened out of trees by wild dogs, and perhaps the same thing happens in forests of the plains, but I rather doubt it.

Mange.

That many pariah dogs are mangy we know, and this may be communicated to wild dogs. But wild dogs do not ordinarily have much to do with village dogs. In addition to the instance above quoted Mr. Morris informs me that when some years ago wild dogs were at their peak in numbers in the Billigirirangan Hills they appeared to have developed mange very badly. In 1938 three very mangy wild dogs galloped down the ghat road for some distance in front of his motor car.

Major Phythian-Adams draws my attention to the fact that mangy skins are sometimes produced for rewards in the Nīlgiri Hills and writes:—'Some of the dogs killed in 1937 were in a very mangy condition; and a number were found dead, in 1893/94, probably from distemper, sometimes as many as three and four together in one spot.'

Besides the above instances from South India there is a case of mange noted from the C. P. at page 1046 of Vol. xxix.

It is likely that wild dogs, living in burrows and holes in the ground and among rocks as they do, may develop their own skin diseases.

Destruction of Wild Dogs.

Records of the Nīlgiri Game Association show that, during twenty-one years since 1912/13 for which figures are available, the average yearly destruction of wild dogs in the area controlled by the Association was 38. It may be that some of the skins for which rewards were paid were imported from jungles outside the Association's area. The reward at the present time is twenty rupees.

In these days, when the stock of deer in all parts of the country is rapidly lessening, it should be the fixed policy of the Imperial Forest Department to offer Government rewards of sufficient amount to encourage the continual destruction of the wild dog in all Reserved Forests.

Poison.

Apart from the offering of rewards, resulting in the digging out of litters from earths and shooting of dogs in the jungles, the animals can be readily poisoned; but this can only be done *under proper supervision which must include fool-proof precautions against any possible accident.*

Strychnine is the poison generally used. Care has to be taken not to use an over-dose. The correct strength appears to be 10 grains to a half pint of water. Strychnine bihydrochloride should be used as it readily dissolves, whereas ordinary strychnine does not. The poison should be poured into deep stabs and cuts and sprinkled on lumps of semi-detached meat.

The failure of strychnine when used in powder form is well instanced by Mr. R. C. Morris, who writes to me on the 17th December 1939:—

> 'A pack of 14 wild dog was found feeding on a tiger's kill (a buffalo, 24 hours old, the kill I mean!) here yesterday by my men. I went out with my daughter and found the dogs complacently sitting around, within a few yards, watching my men put up a machan (useless of course after wild dogs had been at the kill). We shot two, and then poisoned the kill by sprinkling one ounce of strychnine powder over the open parts, the stomach cavity, the eyes and nostrils (torn out), and into gashes in the carcase. Solution of the stuff would have been better doubtless; the poison in the form of powder seemed to have no effect on the dogs whatever. They devoured the whole carcase, poison and all and seemed to suffer no ill effects; nor did I see any vomit.
>
> The pack scattered in two directions on my arrival next morning; but, although they had gone for some distance, they returned when I imitated their calls with empty ·375 and ·256 cartridge cases, which they answered continuously. We thus got them within easy rifle range again.'

Another method, said to be very deadly (Dunbar Brander) is to inject a goat intravenously by means of a hypodermic syringe with a fairly large needle-bore. The injection should be made into a vein—one in the ear-flap is convenient— and a large syringe (20 c.c.) should be used. Care has to be taken that the bore of the needle remains in the vein and the point does not pierce to the other side on insertion. The strength of the emulsion for this purpose should be about 40 grains to the half pint.

For this goat method it is necessary to find a pool of water at which dogs are drinking, and sit over the pool to ensure that no one removes the 'easy meat' for home consumption. The goat will fall *apparently* dead, but there may be only extreme and exceedingly painful rigor of the muscles, so a blow at the back of the head with a suitable instrument after, say, half a minute, is humane.

Some sportsmen use 'Atlas' Skin-preservative in camp for preservation of skins. Precautions should be taken against accident, so the following excerpt from a Note by Mr. R. C. Morris on the subject, from page 338 of Vol. xxxix, is given:—

> 'I lost a herd of 24 buffaloes through their being allowed to graze on my boundaries where the undergrowth had been treated with diluted 'Atlas' Tree-killer. A planter in this District lost cattle through painting posts in a shed with 'Atlas' Wood-preservative: and cattle have been killed in South India and Burma through their coming in contact with spots where skins had been treated with 'Atlas' Skin-preservative; in every case the material treated with 'Atlas' being licked by the unfortunae animals.'

Attitude to Mankind.

I have been able to find only two instances of wild dogs being said to have been aggressive to man. Colonel Caton Jones (Vol. xviii, p. 194) relates that the wild dogs of Nimar were very bold; that they growled at him several times, and that just before he left the jungles the Forest Ranger informed him that four or five of them had attacked two forest guards who had killed one dog with an axe. He (Col. Jones) feared that unless these wild dogs of Nimar were killed they would soon become man-eaters. That was in 1907, but there were no subsequent happenings.

'Robin Hood' relates in his article—vol. x, page 127:—

> 'As I was walking along a game-track in the Nullamalais I came upon a dog stretched across the path. Instead of bolting away, as wild dogs generally do at the sight of man—the dog rose up reluctantly and slouched in a semi-circle, eyeing me with a sinister look. I was unarmed. The dog at length disappeared behind a bush, and I walked on marvelling at its strange behaviour. I had gone thus about a furlong when I happened to look behind and saw the dog rushing after me at full speed, with its nose to the ground (this was strange as it had already seen me). I immediately faced round with a large stone which I hastily picked from the ground. The dog rushed almost to my feet (still with its nose to the ground and not looking up!) and I hit it a severe blow with the stone, at the same time rushing to meet it with a loud shout. The shout appeared to alarm the dog more than the missile. It started aside and again semi-circled—while I retreated backwards—keeping my face to the dog—in the direction I had come. I did this as I should have gone into thicker jungle had I gone on. I felt convinced that the dog would again attack me there, and perhaps fetch other dogs to its assistance. In

this way I backed out of the jungle to my tent. It was fortunate for me that this dog was alone. Had there been others with it, its aggressive demeanour would probably have incited them to attack.

He sent for his gun, which had gone by a road to meet him further on, and remembering the dog was a slut with dugs nearly touching the ground searched the forest and eventually found a cave concealed in the undergrowth from which the six puppies were taken. During the night the mother came round the camp and the servants were throwing fire-sticks at her all night to keep her off. My impression as to this incident is that there was no intention to attack; it was the very natural desire of a mother to see a possible aggressor off the premises.

Native shikaris of Anaikutti below the Northern slopes of the Nīlgiris say that if a single man comes on a pack eating a kill they will stand their ground: also that a mother bringing meat to her puppies earth will demonstrate.

European sportsmen have not recorded such experiences; but note of Caton Jones above cited may be referred to.

It is fortunate that the attitude of the wild dog to human beings is almost invariably wholly unaggressive: had it been otherwise, mankind in the forest areas would never have been safe from their attacks.

Attitude to larger Carnivores.

No writer on the wild dog of India omits discussion of the widely prevalent belief and assertion of native shikaris and jungle people that wild dogs will, on occasion, attack and kill the tiger; Jerdon, Sterndale, Baldwin, Sanderson, Littledale, Inverarity, Dunbar Brander, Best, Peacock, and others, all touch on this subject.

Dunbar Brander gives two pages of his book to discussion of the question. He once witnessed wild dogs annoying a tiger: and relates a very circumstantial account by villagers who heard a fight in progress: and when after some time they timidly approached the spot found a dead tigress and two dead wild dogs. He concludes that there can be no reasonable doubt that they do occasionally kill tigers.

In his article in Vol. x 'Robin Hood', evidently a Forest Officer of South India, relates occurrences in the Nullamallai Hills, east of Kurnool and south of the Kistna river, where Chenchus are the aboriginal tribe, which converted him from his previous scepticism.

Perusal of 'Robin Hood's' article takes my memory back to 1902 and the Bairnuti Inspection Shed near which Robin Hood witnessed the killing of a Chenchu she-buffalo by a tigress which killed her calf and then, the mother defending her baby, the slaying of the marauder by the angered herd. The heat of those jungles. Terrific!

At page 218 of his very interesting book *Leaves from the Diary of a Soldier and Sportsman,* Major-General M. G. Gerard, who, as he himself told me, had shot 227 tigers before he left India, writes:-

> 'Two sowars of my Regiment (The Central India Horse), who had been out prospecting for me, brought back some scraps of tiger skin as big as a napkin which they had found under the following circumstances. They were informed at one jungle village that a few days previously a tiger had been seen on top of a rock on the plateau above, surrounded all day by a pack of wild dogs. During the night they heard 'a tamasha' as they termed it, and upon my men, accompanied by some of the villagers, repairing to the spot they found the scraps of skin above mentioned.'

I have recently (January 1940) obtained an authentic instance of a full grown tiger having been killed by wild dogs. Mr. G. A. Tippets-Aylmer, a Planter in the Wynaad, South India, tells me that one day some years ago, when in the forests surrounding his Estate, he came across the skeletons of a full grown tiger and seven or eight wild dogs. These were, perhaps, ten to fifteen days old and had been eaten and pulled about by jackals, pigs, porcupines etc. By the bushes having been laid flat and other signs it was apparent that a great fight had taken place. Perhaps, in this instance also, the cause of the combat was interference by the tiger in a hunt in which the pack was engaged.

It has been sufficiently established that wild dogs of the Indian jungles can, and do, kill tigers. Such happenings may not be very common. No case of the kind has come to my personal notice during jungle excursions in many parts of India scattered over a period of fifty years in this country.

It may be that some of these attacks are the result of a quarrel, or for the sport of baiting these animals (Dunbar Brander), but probably also for food when they have not encountered other game; or on finding the blood trail of a wounded beast ('Robin Hood'); and, more likely than all, on the killing by a tiger of an animal being hunted by the dogs and the ensuing fight for their quarry by the ravening pack. That they also kill panther and bear is shown below.

There are several recorded instances of wild dogs attacking panthers and bears. In Vol. v. at page 191 is a case of a large pack of ten or twelve couple treeing panthers in the Central Provinces. Had the business not been interrupted it is likely one or both of the panthers would have been killed. At page 194 of Vol. xviii wild dogs are said to have treed a female panther; and at page 218 Vol. xxx, R. C. Morris describes having seen wild dogs attacking a bear which they would have killed had not a companion's rifle intervened. The dogs were quite mute during the fight. He also relates that he once saw the remains of a panther killed by wild dogs in a patch of Sholaga cultivation. The jungle people (Sholagas) described the fight to him. On that occasion no dogs were killed by the panther: but that the reverse takes place was the experience of another sportsman of those same Billigirirangan Hills who found the remains of two wild dogs which had been killed and eaten by a panther. In the same article is the account given to him by his tracker of a tiger having been killed by wild dogs. At page 744 of Vol. xxxvi is a note of a panther having been torn to pieces by wild dogs. It seemed that the panther had pounced upon one of the dogs which went to drink at a pool and the noise it made had brought the pack from the neighbouring cover. No trace of any other dog being killed in the fight was found. Following this note is an account by Colonel J. Pottinger of having witnessed a panther being driven off its kill at 9 p.m. on a bright moonlight by a pack of ten or fifteen wild dogs.

Mr. L. E. C. Hurst tells me that he saw a bear treed by wild dogs in the Chanda forests, C. P.

No instance of hyænas or jackals being killed by wild dogs is related. Perhaps there is, as Dunbar Brander remarks, a blood-brotherhood bar.

Wild dog versus *Domestic dog.*

A case of a wild dog being killed by two domestic dogs—a Ceylon Beagle and a Cross-bred Airdale-cum-Irish terrier—is recorded at page 949 of Vol. xxxvii. The wild dog was three-quarters grown and alone among the tea bushes. At page 343 of Vol. xxiii is a case of two pariah dogs keeping a panther off his kill after dark. And at page 428 of Vol. xxxiii of a pariah dog, tethered for a panther near a village, successfully resisting the effort of the pard to make a meal of him until the watcher in the machan was able to plant a bullet. All pariahs are not curs.

At page 200 of Vol. xxxiii Mr. Peacock asks for an instance of a single domestic dog successfully joining battle with a wild one, and gives a photograph of his bull-terrier who would have probably given the Malay wild dog pictured with him 'a very thin time' had they clashed teeth !

'My dog chased a wild dog but others came and followed him to within a few yards of me' (Pythian-Adams). Dunbar Brander mentions a similar incident actuated, probably, by curiosity.

Methods of Hunting and Seizing.

The wild dog mostly hunts by day, especially in the early hours, but not infrequently on moonlight nights, and occasionally on dark nights. They are on the move early in the morning, and it is then they get on the trail of some animal the fate of which is sealed once the hunt has begun in earnest and they have 'settled down to the long, lobbing canter that can at the last run down anything that runs.' That *sometimes* packs will relinquish the chase is instanced by a stag sambhur, hunted to a river at a place where there was a long, wide pool, swimming to the further bank, the pack having him in full view. Yet the dogs abandoned the hunt. That was on the Denwa river, C.P. (L. E. C. Hurst).

They must have excellent noses. Littledale's *Cuon* bitch sought her food more by scent than by sight. Often when she did not see clearly where a bit of meat had fallen she would nose it out with great quickness. In this respect her sight improved: at first it was very bad. He describes the characteristics of the wild dog to be:—'fierce yet shy; no amount of training could teach it to be gentle; shyness and distrust of man; fierceness and currishness combined; swiftness in snatching; tenacity in hanging on these are the strong points.'

'In the adult animal' he observes, 'the senses of hearing, sight, smell, must be developed to an extraordinary degree of perfection, judging from this animal alone'. That this power of scent is extraordinary is shown by the fact that they can follow a line in the hot weather when the ground is dry as a bone.

Besides being provided with all the highly developed senses necessary for successful hunting, as also extraordinarily muscular bodies, the wild dog has acquired, as has the wolf, an aptitude for team work. That they hunt in concert is certain. This has been seen in the Nīlgiri hills where open hillsides, wooded hollows, and distant views provide ideal conditions for such observations. La Personne remarks upon their team work at page 239 of Vol. xxxvi.

'Around Anaikutti and Mudumalai at the foot of the Northern slopes of the Nilgiris wild dogs come out of the jungle on to a forest road about 7 a.m., and there idle about for some time performing their morning offices and, presumably, discussing the day's plans. They must be able to communicate or team work would not be possible.' (Phythian-Adams). Those who have kept dogs of various breeds must have noticed that they undoubtedly communicate ideas.

A moonlight hunt, as also the keeping of a tiger off his kill, is described at page 443 of Vol. xxxv.

In *A Game-Book for Burma* the author remarks that he has never seen a wild dog's kill at any distance from water; and that the quarry is almost invariably run into, or runs into, a pool or a stream of water in which it is bayed or torn to pieces.

Hunted deer undoubtedly take to water, when there is any, wherein they have some chance, if not too submerged, the stags by use of antlers and those without by striking with fore-feet, of defending themselves. But there are not many pools of water, and no streams, in many dry jungles where wild dogs are numerous; so it is probable that the main cause of hunted animals being killed in pools and streams is not that the water is a place of refuge, but because hunted animals are naturally forced more and more down hill as they become exhausted. Most parts of Burma are better watered than much of the jungle country of India; so this is the reason why wild dog 'kills' in the former country are almost always found near water.

Seizure is made in several ways. Tearing bites at the flanks by which the animal is disembowelled; and, as Dunbar Brander says, seizure by the ears, nose, eyes, lips, hanging on like leeches, bearing down the head, quietly waiting and never letting go until the end. 'Robin Hood's' 'lovely little russet-red balls of fur' well demonstrated this tenacious grip. No wonder few animals escape them. He, and others also, relate how a wild dog will cling to the back of a galloping animal and not be shaken off even when the heavy beast comes crashing to the ground.

The terrified heart-rending screams of victims of the hunt once heard can never be forgotten. It is Nature at its worst. The red fiends do not even wait until the prey is dead.

No doubt the testicles are sometimes seized. Dunbar Brander shows that this is accidental and not a habit. It is possible however that some dog may learn by accident the efficacy of such a hold. In Vol. xxxiii, at page 704, is an interesting account of pig-hunting in Java by 'native fox-red pariah dogs, '*gladak'*, said to be descended from wild dogs possibly crossed with jackal, and 24 inches at the shoulder. These had evolved perfect team work, and one of the pack, always the same dog, invariably seized by the testicles which he removed in one rending mouthful.

Mr. L. E. C. Hurst tells me that one of his pig-hunting hounds always seized a boar by this hold. At page 813 of Vol. xxxi Mr. Salim A. Ali writes that he saw a sambhur just killed by a pack of wild dogs and, strangely enough, the only part touched in the hind quarters were the testicles, which were clean missing. There are other cases also.

Seizure by the eye is common. The Chenchus of the Nullamalais affirm that wild dogs always seize game by the eyes if possible.

In some instances the eye is removed without damage to the lids. That is a fact and is due no doubt to eyes of deer being rather protuberant. Inverarity notes that the eyes are eaten immediately, but doubts whether the dogs seize at that spot. Since his day—1896—many observations have been recorded. At page 389 of Vol. xxxviii Livesey notes that a sow had both eyes removed without damage to the lids or any other injury to the head. That supports Inverarity. At page 267 of Vol. xxviii a Thamin was killed before the wild dogs had run into it: one eye was freshly torn out, the other badly gashed. That upsets Inverarity and supports the Chenchus.

Instances of single dogs successfully hunting deer are not infrequently recorded. They often hunt in pairs, but this is probably only during the breeding season. R. C. Morris notes that he once saw a solitary large dog watch a sounder of pig into a patch of tall sword-grass, and then follow the sounder into cover. It was soon chased out with loud noises ! by a wild boar: and on another occasion he saw a large solitary dog watching, and edging down to, a 'tat' pony that was grazing in the jungle.

Packs may number from a small number up to as many as forty, and perhaps even more. The Author of the *Second Jungle Book* may have had good reason for writing 'The dhole do not begin to call themselves a pack till they are a hundred strong'.

Sometimes single dogs are met with, separated from the pack by some mishap, and these are no less care-free—'bold and saucy' as 'Hawkeye' aptly expresses it—in their demeanour than when in company. I have notes of three in particular. One stood by the road while the car was stopped to observe it at a distance of fifteen feet. Another, U. P., was lame and came to a recent kill of a cow by a panther, driving off the vultures and tearing off chunks of meat which were thrown in the air and bolted whole. In the C. P. a lone dog came to a tiger's kill in the evening. He had a stumpy tail the end of which was completely healed. Bitten off in a fight? Damaged, fly-blown, and self-removed? I had seen him the day before and missed him with the ·22 rifle. I saw no other dogs in that part of the Jarkahu Shooting Block. The first I knew of his arrival was a loud staccato hyæna-like noise under my tree. Very shortly the red dog crept out—well he knew the danger of such a chance meal as this—and was soon at work. There was a marked difference in his now confident demeanour from that of a jackal in similar circumstances.

After breaking into the stomach from behind, where the tiger had made things easy for him, he deserted this unpleasant dish and attacked the flank where he soon had a six-inch piece of the hide off. It was wonderful to watch him make a small entry and then cut his way along with his back teeth (one short at back of each side of his lower jaw!) as neatly as one would do with a pair of scissors. I have watched a young tiger, also panthers, effect the same neat removal of skin. The dog left at dark and returned at 11 p.m., by which time the tiger had been shot and was lying some way off. The dog stayed a few minutes only and returned early in the morning. He chased away an intruding jackal—such a hasty pebble-scattering departure! I talked loudly to him without making him look up. He took no notice of my powerful whistle. Even when my signal horn was loudly blown to call up the men he merely jumped about in astonishment—not in alarm—and failed to locate the startling noise sounded from a short twenty feet above his head.

I have noticed the same thing with jackals, foxes, deer, and wild pig, all animals unaccustomed to look above ground level for their enemies. It has rather surprised me to read in *Jungle Days,* a book published in 1935, of a wild dog's behaviour at a tiger kill:—'After ten minutes the dog displayed great cunning and knowledge, for he began to look up systematically into each tree around him, and eventually caught sight of the machan and was shot'. And some time ago a writer of thrilling shikar yarns in an illustrated weekly, describing a buffalo-tiger fight, related how a jackal came to the kill from the neighbouring jungle, looked up from a distance of forty yards (I am not sure it was not sixty), saw the watching sportsman in his machan, and bolted into the forest. Such happenings are contrary to my observations.

Indifference to pain.

It has been observed by most of us who have shot wild dogs how indifferent to pain they appear to be. Never a sound will they utter however severe the wound, and will go miles with a body wound or a broken limb. Even when closely approached to put them out of pain they utter no sound and do not attempt to attack or bite. (page 389, Vol. xxxviii).

Best writes in 'Indian Shikar Notes' that he has seen a wild dog turn and swallow his own protruding entrails, which had to be dragged from its throat with some force after the beast was finally killed. Phythian-Adams has seen a wild dog tearing at the guts of a wounded companion. I have read somewhere that a panther was seen to remove its entrails protruding from a stomach wound and impeding its progress. Many animals appear not to suffer pain from severe wounds. From my own experience I can say that sudden severe injuries do not cause pain; no doubt it is the shock to the adjacent nerves. But that is not always the case. A man shot through the stomach from behind at close quarters, the Martini Henry bullet missing the spine, suffered shrieking agony and tore at the extruded entrails with his hands. A tiger or panther with a stomach wound is fighting mad, though the latter is pretty mad on very slight provocation!

It is certain however that the wild dog shows less sign of pain than any other beast known to sportsmen in India.

Fluctuating population.

Various writers and observers have remarked upon the apparently causeless fluctuating wild dog population in a given tract.

At page 162 of Vol. xli Mr. Theodore Hubback writes:—

> 'It is possible that wild dogs have a period during which they progressively increase and then due to some unknown reason become scarce, again increasing until some unknown peak is reached. This phenomenon is well recognized among some species, the Ptarmigan of Alaska being a striking example. It is Nature's way of adjusting; and something of this sort may operate to keep wild dogs within limits.'

The wild dog must have a very wide range within any given tract of country, and no doubt move to more distant places when game has been too much hunted by them; but the fluctuations seem to be greater than can be so accounted for. It may be that distemper carries off a large number from time to time, but there must be also other causes at work. Perhaps it is that when food is plentiful the number in litters increases, and *vice versa*.

In a book *Work and Sport in the I.C.S.*, it is stated at page 144 that a District Superintendent of Police—Mr. Sandell—serving at the time in the Eastern Ghats in the Madras Presidency, died from hydrophobia the result of being bitten by a wild dog. The circumstances are not related. It is conceivable that rabies would be passed by jackals to wild dogs, but this is the only case of the kind to be found; so it is not likely to be of very common occurrence.

In 'The Origin of Species' I find:—

> 'We may confidently assert,—that all animals and plants are tending to increase at a geometrical ratio,—that all would rapidly stock every station in which they could anyhow exist,—and that this geometrical tendency to increase must be checked by destruction at some period of life,' and 'In looking at Nature it is necessary never to forget that every single organic being

may be said to be striving to the utmost, to increase in numbers; (with the exception, since Darwin's day, of civilized birth control peoples!) that each lives by a struggle at some period of its life: that heavy destruction inevitably falls either on the young or old, during each generation or at recurring intervals. Lighten any check, mitigate the destruction ever so little, and the number of the species will almost instantaneously increase to any amount. The causes which check the natural tendency of each species to increase are most obscure......we know not exactly what the checks are even in a single instance.'

So, as Dunbar Brander observes, the causes of the serious fluctuations of wild dog population are processes of Nature outside our knowledge.

Does dog eat dog?

We know that in the snowy wastes of the Arctic and Antarctic regions sledge dogs will, under stress of starvation, kill and eat their companions. But can it be seriously put forward as an explanation of the fluctuations of wild dog population that they kill and eat one another, as the writer of a book on sport in Assam has suggested?

'Robin Hood's' wild dogs killed and ate pariah dogs. Mr. L. E. C. Hurst tells me an authentic instance of an officer going on service in 1914 who left his two Rampur hounds in care of servants who kept them chained up and not too well fed. Breaking loose one day they chased a pariah dog down the highway, killed and ate it!

Caton Jones (Vol. xviii, page 195) saw a wild dog bitch return to a three-quarter grown dog which had just fallen dead from poison, and begin to drag it away. Probably it was the mother. He killed another wild dog in the evening, cut off its tail and a strip of skin from tail to ears, and left the remains on the footpath. Next day the dog had been taken away, apparently by wild dogs, as there were no marks of hyæna or panther.

Mr. D'Arcy McArthy tells me that two wild dogs he shot and left lying near the tiger kill on which they had been feeding, while he followed a wounded dog into the forest, had disappeared on his return and could nowhere be found. He concluded the dogs had come back, taken the dogs away and eaten them. 'I believe that they will finish off and devour any wounded members of their packs'. (Best, *Indian Shikar Notes.*)

It cannot be held from those few instances of cannibalism that wild dogs of India kill and devour one another as a habit when they unduly increase in number, or their normal food supply becomes scarce. There is no evidence of that: nor is it probable.

CONCLUSION.

I have to ask Mr. Dunbar Brander to excuse my having so extensively made use of the Chapter on the Wild Dog in his book. There are some interesting comments and observations therein which have not been included by me.

Those interested in the Wild Dog should read this article in conjunction with 'Wild Animals in Central India'. As has been remarked in another place, no sportsman shooting in the jungles of India should be without a copy of that authoritative work.

A fitting end to this article are the following lines from the pen of the master craftsman, author of *The Second Jungle Book*:—

RED DOG.

For our white and our excellent nights—for the nights of swift running,
Fair ranging, far-seeing, good hunting, sure cunning!
For the smells of the dawning, untainted, ere dew has departed
For the rush through the mist, and the quarry blind-started!
For the cry of our mates when the sambhur has wheeled and is standing at bay,
For the risk and the riot of night!
For the sleep at the lair-mouth by day,
It is met, and we go to the fight.
Bay! O Bay!

A LIST OF THE BUTTERFLIES OF THE SIMLA HILLS

Compiled by

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Largely from information supplied by

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So much fresh information has come to hand since the publication of de Rhé Philipe's admirable list in Vol. xxxv of the Society's Journal that the need for a revised list has been apparent for some time.

This list is intended to cover an area roughly corresponding to that included within the Simla Hill States—that is from the edge of the hills in as far as the Thibet border by Shipki Pass, with Chandigarh, Chaur and the Baspa Valley as its eastern limits; and the Spiti Valley, the Jalori Pass and the debouchment of the Sutlej into the plains marking its western. This includes a great variety of country from 2,000 ft. to 20,000 ft. Up to date we have records of the actual capture of 278 different species within this area.

While the commoner species may be caught almost everywhere, dependent, of course, on season and altitude, a knowledge of the best general collecting grounds is essential to the amassing of a representative collection. Bare hilltops, lightly-wooded nullahs containing streams, and certain wooded ridges are generally profitable localities. Of the nullahs, those at San Damiano near Mashobra, above Chadwick Falls, and that between Chota Simla and Jesus and Mary Convent are excellent, especially before the rains. After the rains nullahs of this type are not nearly so profitable, probably because there is no lack of water elsewhere. Other good nullahs are those below the Walker Hospital and the Grand Hotel. The plateau on top of Kufri Hill and the summit of Hutoo are especially good and many valuable specimens may be taken on the Mashobra-Mahasu ridge, Potter's Hill and the country round Narkanda, Bagi and Sungri. In the neighbourhood of Simla, other good spots are Shamri Nullah (the rocky gorge between Simla E. and Tara Devi Hill) and some of the nullahs on Tara Devi itself. For low elevation forms Chandigarh, Koti, the valleys and ravines round Kalka and Chaba (especially the valley between Basantpur and the Sutlej) are strongly to be recommended. The Chaur neighbourhood should be good, but I have only a passing knowledge of it and it seems to have been little worked. In a region such as the Simla Hills there must be many other excellent localities for those with the time and energy to find them.

Horse-chestnut and buddleia blossom are especially valuable in attracting a variety of species, and many good butterflies will be caught in gardens. In this respect it is interesting to note that

I know of 126 different species caught within the last two and a half years in the compounds of Bishop Cotton School and the Preparatory School up here. This number approaches half the entire total of different butterflies caught in the Simla Hills. Many of my most valuable insects have been taken within fifty yards of my office.

The best seasons for collecting are undoubtedly May and early June and after the rains in September and early October, although good butterflies will be taken during all the warmer months in Simla and almost throughout the year at lower elevations. Among the inner hills, beyond the monsoon area, July is the best month—the season for butterflies there is very short and late.

Apart from the 277 species actually recorded in our list there are a number of others which I have included in italics, which, on the analogy of their having occurred to the east and west of us, should probably turn up in our area. Doubtless there are others not mentioned at all which may wander into the district or establish themselves. In this respect it is interesting to note that the two species, *Aporia agathon phryxe* Bois. and *Papilio protenor protenor* Cram. are now very common and not at all rare respectively. De Rhé Philipe noted the former as 'not plentiful anywhere in the district', and the latter he had not met with.

This list is based on de Rhé Philipe's which has simplified our task considerably. Those butterflies that were not mentioned at all in his list I have marked **; those that he mentioned as likely to be caught but of which he had no definite record of capture are marked *. To those that have hitherto been recorded solely as plains and low foothill species and have since been caught in the immediate vicinity of Simla I have given †. A few species have been omitted from his list.

In conclusion we should like to thank Brigadier Evans for his help in identifying many specimens for us.

PAPILIONIDÆ.

1. ***Tros aristolochiae aristolochiae,*** Fabricius.

This butterfly has occasionally been caught below Kalka before and after the rains.

Tros philoxenus philoxenus, Gray.

Tros dasarada ravana, Moore.

There is no record of these butterflies having been taken nearer than Kulu.

2. **Chilasa agestor govindra,** Moore.

Appears only for a very short time before the end of March and during the first two weeks or so of April, although I have a very worn male, taken on May 14th. It is not a common butterfly, but with perseverance it is possible to pick up one or two a year. It will be found in oak forest, and is generally seen flying high among the trees, and will be taken in the wooded country on Tara Devi and at Summerhill.

3. ****Chilasa clytia clytia,** Linnaeus.

May be caught very occasionally at low elevations at the end of March and beginning of April, and again in September.

† v. *dissimilis.*

This may be taken at the same times and places as *clytia clytia* but also extends into the hills where it is taken chiefly in May and early June. We have specimens taken here at Bishop Cotton Preparatory School, 6,800′, 18-5-'38 and 7-6-'39 as well as one caught by Mr. Jones in the Park and another in my collection caught 'somewhere in Simla'. These are our only records at this altitude where it is very rare. Chaba is a likely spot for this and *clytia clytia.*

4. ***Papilio protenor protenor,** Cramer.

The 'Rose Monal' may be taken from the end of March until July though stragglers may be met with as late as the end of August. It is never uncommon though most specimens may be caught about the beginning of the rains. It does not appear after the monsoon.

5. **Papilio polyctor polyctor,** Boisduval.

This butterfly has three broods and may be picked up between March and October from about 3,000′ to 7,500′. To obtain the small D.S.F. butterflies a visit to the bed of Shamri Nullah where it joins the stream from Chota Simla is sure to be rewarded with a number of perfect specimens. Early April is the best time for this form. When the buddleia comes out early in June it is an unfailing attraction to this butterfly, as also are thistles.

6. **Papilio arcturus arius,** Rothschild.

An even more beautiful insect than the last which it resembles. It may be taken above about 7,500′ and can be caught fairly frequently around the San Damiano Nullah. On the whole, though, it is a butterfly most likely to be caught among the hills beyond Narkanda. It may be taken in May, June and again in September.

7. **Papilio polytes romulus,** Cramer.

This butterfly is met with sparingly above 4,000′, up as far as Simla, between April and October. Below 4,000′ it is not uncommon. I have met with numbers below Asni Bridge in July and in the Giri valley below Fagu in September. Of the female forms, *cyrus,* which is rare elsewhere, seems to be the commonest. As *Tros hector* does not appear in northern India and *Tros aristolochiae* only sparingly on the fringes of the district, this is to be expected. I have, however, caught the *stichius* variety at 6,600′ in May and have seen the mimic of *hector* at 5,700′ in October.

8. **†Papilio demoleus demoleus,** Linnaeus.

This butterfly occurs sparingly up to 7,000′. A few orange and lime trees are to be found up to about 4,600′ in the sheltered valleys and the larva will possibly be found feeding on these. I have caught it in Simla in April and May and again after the rains.

9. **Papilio machaon asiatica,** Men.

May be taken from the end of March to September, above about 4,000′. The grassy slopes known as Butt Plain below B.C.S. will often afford one or two specimens but Kufri Hill is better, and it is particularly abundant around Narkanda, on Hatu and among the Alpine meadowland further into the hills. We have the short-tailed *ladakensis* variety from Puri, a short way beyond Shipki, so it may turn up on the Shipki Pass just in our area.

10. ***Pathysa eurous cashmirensis,** Rothschild.

This very local insect has only been taken between the middle of April and the second week of May. It has been caught at San Damiano, along the Mashobra road approaching Mashobra, and at Summerhill.

11. **Zetides cloanthus,** Westwood.

12. **Zetides sarpedon sarpedon,** Linnaeus.

According to our records these butterflies must have a brood at the end of March and another at the end of May, but they may also be taken during the rains and de Rhé Philipe mentions them as post-monsoon species as well. *sarpedon* is not common, but *cloanthus* may often be taken on horse-chestnut blossom and on buddleia. It can also be caught in the valleys settling on damp mud. They have both been taken from about 4,500′ up to 8,900′ (Kufri Hill).

13. ***Parnassius jacquemontii jacquemontii,** Boisduval.

14. ***Parnassius epaphus nirius,** Moore.

These butterflies will not be found below 12,000′. They have been taken on the Bhabeh Pass, Kunawar, and in the Shipki neighbourhood in July, Epaphus is the commoner of the two.

15. **Parnassius hardwickeii hardwickeii,** Gray.

This hardy species is found from 6,500′ (Potters Hill) to 17,000′ (Western Tibet). At the lower elevations it may be caught during every month of the year. In Simla itself only occasional specimens are to be seen, but there are generally some to be caught after the rains on the slopes behind Sanjauli. From Narkanda inwards, before and after the rains, this butterfly is to be found in great numbers on the open slopes where the ground is carpeted with flowers.

16. ****Parnassius delphius stoliczanus,** Felder.

We received four specimens of this very rare 'Apollo' from the Shipki La, 15,000′, this year, taken in July.

Parnassius simo simo, Gray.

Parnassius acco acco, Gray.

Evans gives Shipki as a locality for the former and Spiti for the latter. They are both very rare and we have no information about either.

17. ***Parnassius charltonius,** Gray.

We have a number of specimens from Shipki, 14,000′, taken in July.

PIERIDAE.

18. ****Leptosia nina nina,** Fabricius.

This butterfly has been taken near Kalka and Chandigarh, 2,000′, in October and November. As this must be the extreme western edge of its limits it will of necessity be rare. It is not likely to be found at a higher altitude than 2,000′.

Baltia butleri butleri, Moore.

Euchloe ausonia daphalis, Moore.

Mentioned by Evans as found from Ladak and Chitral to Kumaon, but we have no record of their capture. They will possibly be caught on the inner ranges of the district.

Pieris chloridice, Hubner.

We have specimens from Puri, W. Thibet, one day's march beyond Shipki. It may turn up on the Shipki La.

19. ***Pieris callidice kalora,** Moore.

This has been caught in the Shipki neighbourhood in July above 12,000′ It is not likely to be found below this altitude and will most likely keep to the inner ranges.

20. ****Pieris daplidice moorei,** Robertson.

Fairly common in the Shipki neighbourhood in July above 12,000′.

21. **Pieris napi ajaka,** Moore.

I have not found this a very plentiful species, only having been able to collect two to date, although I have been on the look-out for it. Possibly one is likely to confuse it with the next species, and I believe others have been more fortunate than I. It will be caught in May and June and seems to prefer woodland and to come to water more readily than others of its genus. It can be caught at Mashobra and on Jakko, but it is not likely to be found below 7,000′.

22. **Pieris canidia indica**, Evans.

23. **Pieris brassicae**, Linnaeus.

These two butterflies are so common as to need no description. They will be found almost everywhere during most of the year.

24. ***Aporia nabellica nabellica**, Boisduval.

This extremely local insect may possibly be found in the hills beyond Narkanda above 8,000′. Our specimens come from further into the hills. We have it from Pangi, on the Tibet road, 8,500′, and from the Baspa valley in July.

25. **Aporia leucodice soracte**, Moore.

Around Simla this insect appears during the first week in May and is very abundant until the rains break, when it disappears. It may be taken almost anywhere between 4,000′ and 10,000′.

26. **Aporia agathon phryxe**, Boisduval.

27. ****Aporia agathon caphusa**, Moore.

The light form *phryxe* and *caphusa*, the medium form, are common almost everywhere above 5,000′ from the third week of May until shortly after the beginning of the rains. Some years they literally swarm and are to be seen in great numbers round horse-chestnut blossom. The two forms seem to be equally common.

28. ***Delias eucharis**, Drury.

This species has been taken at Koti, 3,000′, in September, and even as far into the hills as below the Cecil Hotel at Tutikandi, 6,500′, in October, but, as this will be the extreme edge of its limits, it will be very rare in our area.

29. **Delias belladonna horsfieldii**, Gray.

Can be caught fairly frequently from about 4,000′ up to at least 10,000′ from April to June, and again after the rains. I have also a fresh specimen taken on July 11th. It has a habit of flying high, but, like so many other species, it comes readily to horse-chestnut blossom.

30. **Delias sanaca sanaca**, Moore.

Originally taken as a pale form of the last-mentioned butterfly, it appears just before the rains break. It is rather a scarce species, and Kufri Hill is a likely spot to find it, although I have caught it at B.C.S., 6,500′. Both this and the last species extend well into the hills.

Delias thysbe pyramus, Wallace.

Given by Evans as recorded from Simla to Burma, but we have no record of its appearance here.

31. **Belenois mesentina mesentina**, Cramer.

This is very common at low elevations but becomes less so higher up and is not likely to be caught above 8,500′. It will be found from April to June and again after the rains, though I have also seen it at the end of July. It generally keeps to open country and the bare spur about a mile below B.C.S. will generally afford a few.

32. **Huphina nerissa phryne**, Fabricius.

Common during and after the rains at the foot of the hills, but may be taken in fair numbers sometimes round Simla itself. Summerhill, 6,500′, is a favourite spot, but it is not likely to be found higher up nor further into the hills than Simla itself.

33. ****Appias lalage lalage**, Doubleday.

The only recorded specimens were taken in the Glen and at Summerhill, 5 and 7-5-‘38. They were all slightly worn so presumably the best time to look for them would be about a week earlier. Simla is probably the extreme western limit of this butterfly’s range so it is bound to be a great rarity here.

34. ****Appias libythea libythea**, Fabricius.

This is also a great rarity in Simla though it is likely to be of more frequent occurrence at the foot of the hills. We have a specimen from Chandigarh, 2,000′, in November, and one caught at B.C.S., 6,500′, in early September, is the only record for Simla. I suspect that the latter butterfly was on migration as it was caught in conjunction with a number of catopsiliae and other butterflies which I had noticed flying in fair numbers in a northerly direction for three days during a break in the rains.

35. **Catopsilia crocale,** Cramer.

A common plains species which may be caught quite frequently in Simla, and even higher up, during and after the rains.

36. **Catopsilia pomona,** Fabricius.

May be caught at the same times and in the same places as the above and is abundant some years. The male form *catilla* is rather less common.

37. **Catopsilia pyranthe minna,** Herbst.

This butterfly is chiefly a plains species and is of rather uncommon occurrence at the altitude of Simla. Like the two previous butterflies it appears during and after the rains.

38. ***Catopsilia florella gnoma,** Fabricius.

This is not likely to be found higher up than at the foot of the hills where it appears very sparingly. We have specimens from Chandigarh in November and from Chaba, 2,000′, in August.

39. **Gonepteryx rhamni nepalensis,** Doubleday.

Abundant almost everywhere above about 5,000′ during most months of the year.

40. **Gonepteryx aspasia zaneka,** Moore.

This butterfly is not nearly as common as the last and is rather local round Simla though quite common on the open slopes beyond Bagi and very common on the higher parts of the road from Sainj to Chaupal (Balsan State). It will not be found much below 7,500′ and may also be taken on Jakko, at Mashobra and further into the hills in April, May, June and after the rains.

41. **Terias libythea,** Fabricius.

Very plentiful in open grass country from the plains up to nine or ten thousand feet. I have caught a specimen near Sungri at 12,000′. At low elevations it will be met with from early spring till late autumn, but round Simla it will not often be caught except between early July and early October.

42. **Terias laeta laeta,** Boisduval.

Rather less abundant than the last; it, also, round Simla, is confined mainly to the monsoon and post-monsoon months, though at lower elevations it may be caught from spring to late autumn.

43. **Terias hecabe fimbriata,** Wallace.

A common butterfly of the khudsides below Simla during late August, September and October, though, again, at lower elevations it may be caught during most months of the year.

44. ***Colias ladakensis,** Felder.

This is an uncommon species of the inner ranges and is not likely to be found below 12,000′. It has been taken at Shipki, 12,000′, in July.

45. **Colias hyale hyale,** Linnaeus.

Will be caught fairly commonly in open country above about 5,000′, together with its female form, *pallida* Staudinger, and its male form, *erate* Esperance, between March and June and again after the rains. It is rather commoner further into the hills. The two varieties are slightly less common than the typical form and of the two *pallida* will be caught the more often.

46. ****Colias eogene eogene,** Felder.

A rare butterfly of the inner hills which will only be taken at high elevations. It has been caught at Spiti, 12,000′, in July.

47. **Colias croceus edusina,** Butler.

An abundant butterfly from the plains to 15,000′. It may be caught in open country during every month of the year near Simla.

48. **Ixias marianne,** Cramer.

A common species of the plains and foothills which occasionally may be taken in open country round Simla after the rains.

49. **Ixias pyrene satadra,** Moore.

Reported from the plains and valleys up to 7,000′, it has even been caught in Simla, though it is rare above 5,000′. It is quite common below about 4,500′ in the Giri Valley below Fagu and has been reported from the Asni and Sutlej Valleys. We have it from Nachar, 7,000′, B.C.P.S., 6,800′, Giri Valley 4,400′. It has also been taken at Annandale and Chaba. Season during and after the rains.

50. **Colotis etrida etrida,** Boisduval.

This is a plains species that appears sparingly at the foot of the hills. It may be caught higher up, however, as we have a record from Fagu, 8,000′, though this must be most exceptional.

DANAIDÆ.

51. **†Danais aglea melanoides,** Moore.

In June this may be caught rather sparingly round Simla up to the altitude of Kufri Hill (8,900′) where several have been taken. It will be found more frequently in the Kalka district at an earlier date.

52. **Danais tytia sita,** Kollar.

This is a hill species which is not likely to be taken much below 4,000′. Though never abundant, it is not an uncommon species and may be taken fairly frequently in the valleys, in Simla and even as far inland as Narkanda. It generally flies high. Season from April to June, and after the rains.

53. **Danais limniace mutina,** Fruhstorfer.

This is mainly a plains butterfly but it is by no means uncommon in Simla itself, though it is not likely to be taken much higher up. Here it may be taken from May to June and again after the rains.

54. **Danais melissa septentrionis,** Butler.

May be taken rather infrequently above about 4,000′ in the spring and autumn.

55. **Danais plexippus,** Linnaeus.

Round Simla it may be taken in April and May and again after the rains. It is not common at this altitude and will not be caught much above 8,000′.

56. **Danais chrysippus,** Linnaeus.

A much more abundant species than the last-mentioned in this area, it may be taken very frequently round Simla in April, and less so after the rains. It extends a fair way into the hills and I have seen it at about 9,000′ beyond Bagi, but this is probably about its maximum range. Both this and the latter prefer open country and are commoner at lower elevations, where they may be caught throughout the year.

57. **Euploea mulciber mulciber,** Cramer.

The range of this butterfly is given by Evans as 'Simla—Burma' and de Nicéville has recorded it as taken 'near Kalka.' However we have no information about it and have no other record of its capture.

58. **Euploea core core,** Cramer.

59. **Euploea core vermiculata,** Butler.

Vermiculata is the hill form, but it is much scarcer throughout this area than *core core.* Both are common from the plains up to about 4,000′, but above that they are rather rare and will not be caught much above Simla. The season at this altitude is from May till autumn, though more protracted lower down.

SATYRIDÆ.

Mycalesis francisca sanatana, Moore.

Given by Evans as appearing from 'Kulu to Burma', but we have no record of its capture.

60. **Mycalesis perseus typhlus,** Fruhstorfer.

61. **Mycalesis perseus blasius,** Fabricius.

De Rhé Philipe states that both of these occur fairly frequently at low elevations throughout the warmer months up to 3,000′, but the only specimen we have is of blasius from Chaba, 2,000′, taken in March.

62. **Mycalesis mineus mineus,** Linnaeus.

Not uncommon at low elevations and occasionally taken as high up as 6,000′. We have specimens from Kalka in March and August. It is likely to be taken during most months of the year.

63. **Mycalesis visala visala,** Moore.

This butterfly is fairly common towards Mussoorie, but our area is rather out of its range, so it is only likely to be taken very occasionally at low elevations in the Kalka district. Specimen from Chandigarh, 20-10-37.

64. **Mycalesis lepcha lepcha,** Moore.

This is the only member of the genus likely to be taken at the altitude of Simla. It is by no means common but I came across a fair number this year at the end of May in the Nullah between the Convent and Chota Simla at 7,000′. This must be about as high as this species ventures. Hitherto I had only caught it in early April in one of the Nullahs this side of Tara Devi, and here, at 6,800′, in the compound. Like all members of the genus it prefers jungle country, and up at Simla, at any rate, the D.S.F. seems to be the only form that appears.

65. **Lethe sidonis vaivarta,** Doherty.

All the members of this genus are lovers of forest country and the majority of them will be found not lower than 7,000′. Their real habitat is the forest strip between Narkanda and the inner mountains where the forest country ceases at the end of the monsoon area.

This species is not common in our district and our specimens come from 9,000′ in Kulu, de Rhé Philipe mentions having caught one or two near Simla, but it will undoubtedly be found near Narkanda from July to the autumn.

66. **Lethe maitrya,** de Nicéville.

Not an uncommon insect in the Narkanda forests. It is not likely to be found much below 8,500′, and flies in the autumn.

Lethe nicetas, Hewitson.

We have no record of the capture of this insect. It will probably be found in the Narkanda-Bagi country in the autumn.

67. **Lethe jalaurida jalaurida,** de Nicéville.

Is found rather sparingly in the Narkanda-Bagi country and in Kulu above about 8,000′ from June to September.

68. ***Lethe goalpara narkanda,** Fruhstorfer.

A rare species found in the same country as the above. Specimens from Hutoo, 9,500′ and Kulu, 9,000′, in July and August.

69. **Lethe rohria dyrta,** Felder.

Very common 6,000′—9,000′ from the end of March to October.

70. **Lethe confusa confusa,** Aurivillius.

Differs from all others of the genus found in our area in being mainly a low altitude insect, and near Simla it does not seem to come much above the 3,500′ mark, although we have a specimen from Nachar taken at 7,000′. It will be taken from Spring to Autumn, but is not a common species.

71. **Lethe insana insana,** Kollar.

A rare and rather local insect whose real home is the country beyond Narkanda, though de Rhé-Philipe reports captures on the Mahasu—Mashobra ridge and we have a record of one from Simla at 7,000′. I found it common in the middle of September one year in the forest just beyond the Dak-Bungalow at Sungri, 8,500′. It flies very slowly and is easy to catch.

72. **Lethe verma verma,** Kollar.

Very abundant in suitable country from May to September 6,000′-9,000′.

73. ***Lethe pulaha pulaha,** Moore.

A rare butterfly of the inner hills. We have two from Wangtu, 6,000′. taken in August.

Lethe yama yama, Moore.

Given by Evans as appearing from 'Kulu to Burma'; but we have no record of its capture as far west as this. If it is taken it will probably be found in the Narkanda country just before the rains.

74. **Pararge schakra,** Kollar.

Very common at most seasons above 6,000′. Favours sunny banks of roads, rocky hillsides etc.

Pararge moerula, Felder.

A rare butterfly of the inner hills which will not be taken much below 10,500′. Recorded from Lahoul and we have a dubious specimen from Shipki at the end of May.

75. **Pararge moorei,** Butler.

A very local but not uncommon butterfly in the places it chooses to inhabit. It is most likely to be taken at the end of August and can be caught on the Thibet road by the Rest House at Kufri. De Rhé Philipe also mentions other places on the Mashobra-Mahasu Ridge between May and September.

Orinoma damaris, Gray.

Recorded by Evans as extending from 'Kangra to Karens'; but we have no record of its capture in our district.

76. ***Maniola pulchra pulchra,** Felder.

77. **Maniola lupinus cheena,** Moore.

78. ***Maniola daveudra davendra,** Moore.

These three butterflies are all inhabitants of the high inner hills and have been taken in Lahoul, at Shipki and Wangtu, above 12,000′, in July. *Pulchra* is common and the other two considerably less so.

79. **Eumenis parisatis parsis,** Le Cerf.

A local, but not uncommon, insect in the places it chooses. It favours open, rocky country between 6,000′ and 7,500′, but may be caught in other localities. I have seen a number on the road to Wildflower Hall beyond the Dhali filter beds, and also flying over the cricket ground at Chail. Season; early May to early July and during breaks in the rains.

80. ***Eumenis mniszechii baldiva,** Moore.

Not uncommon in the inner ranges above about 11,500′ in July. Specimens from Wangtu, 11,500′, and Shipki, 13,000′.

81. **Aulocera brahminus brahminus,** Blanchard.

De Rhé Philipe gives Kulu and the Sutlej above Rampur, but this must be exceptional as our experience points to its being a high elevation butterfly seldom found nearer than the Baspa Valley at about 13,500′. We have specimens from the Baspa Valley in July and, judging from the numbers of this insect we have had brought to us from the Shipki neighbourhood, it must be common there.

82. **Aulocera padma padma,** Kollar.

A common butterfly which appears towards the end of April and is most abundant just before the rains break. A much scantier brood appears after the rains. Flies from about 6,000′ to 10,000′, but is commonest above 7,500′.

83. **Aulocera swaha swaha,** Kollar.

A fairly common species which makes its appearance at similar altitudes to the last during the middle of August. It seems to patronise sunny forest glades and the edge of wooded country, whereas . . .

84. **Aulocera saraswati,** Kollar,

is more a butterfly of the open khudsides where it swarms from mid-August until after the rains. It descends lower than *padma*. Both will be caught up to quite 10,000′.

85. ***Erebia kalinda kalinda,** Moore.

An uncommon species of the high hills. Several specimens from Shipki, 14,000′, and the Baspa Valley, 12,000′, taken in July, '39.

86. ***Erebia shallada shallada,** Lang.

A rare species of the high inner hills above about 12,000′. We have it from the Rhotang Pass in July at 13,500′.

87. **Erebia nirmala nirmala,** Moore.

88. **Erebia scanda scanda,** Kollar.

89. **Erebia hybrida,** Butler.

90. **Erebia annada caeca,** Watkins.

Apart from *scanda* which may be recognised by the white irrorations on the under hindwing, these are confusing members of the genus to separate in flight, though once caught it is a fairly easy matter. The first three favour damp wooded localities, but *annada caeca* seems to prefer open country; they all fly with the same distinctive hopping flight.

Both *hybrida* and *annada caeca* are double brooded, the former being caught in the middle of May and the middle of August, and the latter, the first and the last of the four to appear, will be taken from mid-April to the first week in May, and again early in October. They will be taken from about 5,500′ to 8,500′.

Neither of these is as common as *scanda* which appears during early and mid-August. However, much the commonest of the four is *nirmala*, which swarms in forest country from the end of May to July and later. They will be taken from about 5,000′ to 8,000′.

91. **Erebia hyagriva,** Moore.

Generally a distinctly scarce member of the genus, though one year I found it fairly abundant. It very much resembles an *Ypthima* and inhabits the same open hillsides and lightly wooded country, where it may be taken from 5,000′ to 8,000′ at the end of August and in September.

92. **Ypthima nareda nareda,** Kollar.

A common butterfly from May to October, 5,000′ to 8,000′. Like other members of the genus it prefers open hillsides and lightly wooded country.

93. **Ypthima asterope mahratta,** Moore.

A plains species which does not extend any distance into the hills. Common about Kalka and Chandigarh after the rains.

94. **Ypthima hubneri hubneri,** Kirby.

Also a plains species which may be taken sparingly at low elevations up to a height of 6,000′ after the rains.

95. **Ypthima avanta avanta,** Moore.

Will be caught occasionally from low elevations to about 4,500′ during and after the rains. We have no record of the D.S.F.

96. **Ypthima baldus baldus,** Fabricius.

May be taken fairly abundantly below about 5,000′ on the Khudsides in March and early April. Above 5,500′ it is rare but I have caught it here at 6,800′. It will also be taken during and after the rains.

97. ***Ypthima indecora,** Moore.

Will be taken very sparingly up to 5,500′ during the rains. We have records of its capture below Annandale.

98. **Ypthima sakra nikaea,** Moore.

Very common in suitable country from May to October, 4,000′ to 9,000′.

99. **†Melanitis leda ismene,** Cramer.

May be taken very sparingly in wooded country up to 6,500′ before the rains and also in October and November in the Simla neighbourhood, more commonly at lower elevations.

100. ****Melanitis phedima galkissa,** Fruhstorfer.

A very scarce butterfly near Simla, though presumably met with more frequently at lower heights. Specimen taken behind Jakko 29-5-39, 7,000′, and two or three worn specimens at 6,000′ in June.

NYMPHALIDAE.

101. ***Charaxes fabius fabius,** Fabricius.

Very rare here. Recorded from Jubilee Hill, 6,500′, in late April.

102. **Eriboea athamas athamas,** Drury.

May be caught from plains level up to at least 9,500′ before and after the rains. It is not a particularly common species and, like others of the genus, is not easy to catch. It may be taken in all types of country.

103. **Eriboea dolon dolon,** Westwood.

This beautiful butterfly is a rarity here. I only know of two spots where it may be taken. One is the nullah between Chota Simla and the Convent, and the other is on the Retreat Hill behind the water tank at Mashobra. It is on the wing for a very short time from the third week in May and nearly always flies about the tree tops. I have been told that it may be brought within catching distance by means of throwing up a handkerchief wrapped round a stone . . . being a fighting insect it pursues it on its downward course. Probably the best method of taking this insect is to climb a tree which it favours and to await it there with a long-shafted ‘ dodger ’. I have seen several of these butterflies but the only one I have myself caught was one that was misguided enough to take an excursion near the ground. However it is caught, this butterfly is a prize well worth having.

104. **Dilipa morgiana,** Westwood.

This rather rare butterfly may be taken from about 2,500′ to at least 7,500′. It seems to have three broods as we have records of catches from Chaba, 3,000′, at the end of March, Shamri Nullah, 4,700′, at the beginning of April, and from Simla in June and after the rains. The male is rather uncommon but one or two may be taken each year. The female, however, is excessively rare and I only know of two records of its capture, one that de Rhé Philipe mentions near Sipi and one I was lucky enough to obtain at B.C.S. shortly after I had started collecting—beginner’s luck! This butterfly is greatly attracted by rotting fruit.

105. ***Apatura ambica ambica,** Kollar.

A great rarity of which we know of one capture only . . . in late September above Chadwick Falls. Rumour has it that it may be taken on the last 'tibba' at the Simla end of Tara Devi. It should also be caught before the rains.

106. **Sephisa dichroa,** Kollar.

Found from 3,000′ to 8,000′ in late May, occasionally during, and again after the rains. It is rather local but will be found commonly enough in damp nullas in oak forest where it comes readily to water. It may be taken freely at Chadwick Falls, San Damiano, behind Jakko and from the Tara Devi Nullahs.

107. **Diagora persimilis zella,** Butler.

A somewhat scarce insect that may be caught from April to June. I have caught it both in open and lightly wooded country.

Diagora nicevillei, Moore.

This rare butterfly has been recorded from Dalhousie and Mussoorie, so it may be taken in our area.

108. ****Hestina nama,** Doubleday.

One specimen taken in Simla 25-5-'39. This is an extension of its range. Hitherto it has not been recorded as far west as our district.

Calinaga buddha buddha, Moore.

We have no record of the capture of this insect in our area though we know of some taken in Kulu. It appears in the early spring.

109. **Stibochiona nicea nicea,** Gray.

Has been caught in the Sutlej valley near Rampur, but apart from that we have no information about its appearance, so it is presumably very rare. It should be taken just before the rains.

110. **Euthalia garuda anagama,** Fruhstorfer.

Will be caught rather sparingly round Kalka wherever the mango tree grows and rarely into the hills up to 7,000′. We have a record of its capture on the Ridge in June. At lower altitudes it will be taken from early spring to late autummn.

111. **Euthalia lubentina indica,** Fruhstorfer.

Very rare in our area; though it has been caught up to the elevation of Kufri Hill, 8,500′, the low river valleys are more likely to harbour this insect. Season --- summer and autumn.

112. **Euthalia patala patala,** Kollar.

Will be picked up, not uncommonly, in the neighbourhood of oak forest from the beginning of the rains to August. It is very fond of rotting fruit.

113. **Limenitis danava,** Moore.

A rare butterfly, especially here, the western edge of its range. I took a specimen in the nullah between Chota Simla and the Convent, 17·5. and we have records of two others from Chadwick Falls, 6,500′, in mid-April. It may also be taken after the rains. Before the rains, damp nullahs would seem to be the most likely spots to effect a capture.

114. **Limenitis trivena pallida,** Tytler.

This butterfly is rather local and is out for a short period just before the monsoon, appearing during the third week in May. It may be taken in very great numbers on the Mashobra-Kufri Ridge and I have also had it behind Jakko, and at Theog. It does not seem to descend much below 7,000′.

115. **Pantoporia selenophora selenophora,** Kollar.

Record from Patalnala, this side of Chaur, which is probably the western limit of its range. It is not uncommon further east.

116. **Pantoporia opalina opalina,** Kollar.

Very common in spring and autumn in damp nullahs, clearings in forests, etc. from about 4,000′ upwards.

117. ***Pantoporia asura asura,** Moore.

A rare butterfly that may occasionally be taken above about 6,000′ before the rains. We have a specimen from Simla, 6,500′, taken in June and one from Nachar, 7,000′ (inner hills) in July.

118. **Pantoporia perius**, Linnaeus.

A plains species that occasionally finds its way up to Simla. I caught a specimen here 29-5-38, and we have a record of one taken on 20-9-37, at 3,000′.

119. **Neptis mahendra,** Moore.

A common butterfly from the beginning of May until autumn above about 6,000′ in the usual localities favoured by members of this genus. . . damp nullahs and forest clearings.

120. **Neptis hylas astola,** Moore.

121. **Neptis hylas varmona,** Moore.

Very common butterflies from spring to autumn; *varmona* will be found in the foothills and *astola* higher up.

122. **Neptis yerburyi yerburyi,** Butler.

Rather similar to *mahendra* in appearance though slightly less common. It will be caught in the same localities as *mahendra* but it appears at rather an earlier date, being caught from early April up till the rains and again at the end of September, and at the beginning of October. It will be caught between about 6,000′ and 8,000′.

123. **Neptis sankara sankara,** Kollar.

A very local butterfly that appears just before the rains between about 4,500′ and 8,000′. It may be caught in plenty at San Damiano, Chadwick Falls and in the nullah between Chota Simla and the Convent.

124. **Neptis ananta ananta,** Moore.

This is a great rarity here and the first specimens we had come across were caught between June 2nd and 5th this year at 5,500′ in the nullah below the Walker Hospital.

Neptis zaida zaida, Doubleday.

Given as occurring from Murree to Kumaon; but we have no record of its being taken in our area. It is a low elevation butterfly and appears in the early summer.

125. **Cyrestis thyodamas ganescha,** Kollar.

Will be found from fairly low elevations up to about 7,500′. It is a familiar butterfly which may be caught in any sort of country except deep forest and bare hillsides, though it has a decided preference for the neighbourhood of water. It can be taken from early May until the autumn.

126. **Pseudergolis wedah,** Kollar.

Rather a local butterfly which will not often be found away from water. In certain nullahs, such as that above Chadwick Falls and the nullah between Chota Simla and the Convent, it is common. It may be taken from early spring to the autumn.

127. **Hypolimnas misippus,** Linnaeus.

Neither of us have caught this butterfly in Simla, nor seen specimens that were definitely taken here, but we have sufficient information to state that this species does occur at this height after the rains. In the Kalka neighbourhood it is of more frequent occurrence.

128. **Hypolimnas bolina,** Linnaeus.

May be taken very sparingly in Simla in September and October, rather more frequently below 5,000′.

129. **Kallima inachus huegeli,** Kollar.

This butterfly is by no means common here. A few may be seen each year, however, though possibly not caught, because it so often settles in inaccessible spots. It will be taken during May and early June and again after the rains. It will not be found very often away from oak forest and consequently will be caught between about 3,000′ and 8,000′. I have found the forest country below the K. S. Railway on the Simla side of Tara Devi good country for this butterfly.

130. **Precis hierta hierta,** Fabricius.

131. **Precis orithya swinhoei,** Butler.

Both common plains butterflies. *Orithya* is common up to 6,500′; ***hierta*** is not nearly so common. Both seem to favour dry river beds and other stony ground and they may be taken up to 8,500′ from spring to autumn.

132. **Precis lemonias persicaria,** Fruhstorfer.

A fairly common species that may be taken in gardens up to about 8,000′ at the end of April and the beginning of May, during suitable weather in late July and early August, and again at the end of September and the beginning of October.

133. **Precis almana almana,** Linnæus.

A common butterfly in the plains and hills below 4,000′ from spring to autumn, but rather a rarity in Simla, where I have taken it at the end of September.

134. ****Precis atlites,** Linnæus.

Of rare occurrence in the Kalka district where we have taken it in October and November.

135. **Precis iphita siccata,** Stichius.

A common butterfly from low elevations up to about 9,000′. It may be taken from spring to autumn.

136, **Vanessa cardui,** Linnæus.

An abundant butterfly from the plains up to about 10,000′. It flies during most of the year and will be freely caught in gardens and in the neighbourhood of thistles.

137. **Vanessa indica indica,** Herbst.

A very common butterfly which will be caught in the same type of country as the last, above about 4,000′.

138. **Vanessa canace himalaya,** Evans.

A common butterfly in the neighbourhood of water. May be caught from early spring to late autumn, from low elevations to quite 9,000′.

139. ****Vanessa egea cognata,** Moore.

A very rare butterfly near Simla. One was taken at 7,000′, but we know of no others taken so low. I have taken them on the summit of Hatu 12-9-38 and have heard of others being taken in that neighbourhood. We also have specimens from Shipki and Chini at 12,000′ in July. In the nearer hills it may also be taken in June. I can recommend the patches of meadow land between 10,000′ and 11,000′ on Chaur, the Kala Bagh side, as being a headquarters of this insect—in mid September at any rate. Numbers can be seen and will be easily caught as they readily settle on flowers.

Vanessa ladakensis, Moore.

Given as extending from Ladak to Sikkim. No information.

140. ****Vanessa urticæ rizana,** Moore.

A rare butterfly of the high inner hills. Specimens from the Shipki Pass, 15,000′, in July.

141. **Vanessa cashmirensis aesis,** Fruhstorfer.

Will be found during every month of the year round Simla. It is common from about 5,000′ to 15,000′.

142. **Vanessa xanthomelas fervescens,** Stichius.

Round Simla this butterfly appears in early spring and flies till May. It is rather local but not uncommon in certain damp nullahs. In the Narkanda neighbourhood it is commoner, appearing at a later date and flying till the rains.

143. **Symbrenthia hippoclus khasiana,** Moore.

May be taken occasionally from low elevations up to 7,000′ in June. Most of my specimens have been taken on buddleia flowers.

144. **Symbrenthia hypselis brabira,** Moore.

May be taken very sparingly from about 4,000′ to 7,000′, from early spring until the rains and again after them. We have two specimens taken at 6,000′, 8·4. and 14·4.

Symbrenthia niphanda hysudra, Moore.

A rarity throughout its range, Kashmir to Kumaon; we have no information about it.

145. **Argynnis hyperbius hyperbius,** Linnæus.

Will be found, not uncommonly, from plains level to about 7,000′, June to October, in open country, glades and gardens.

146. **Argynnis childreni sakontala,** Kollar.

A common butterfly from May to July and again after the rains, above about 5,000′.

147. **Argynnis kamala,** Moore.

Abundant above 7,000′ and appears at the same seasons as the last mentioned. Both species may be taken in plenty on Kufri Hill. It is very fond of flowering thistles.

148. **Argynnis adippe jainadeva,** Moore.

Will not be found much below 10,000′. It has been caught on the Jalori Pass and we have specimens from the Shipki Pass in July. It may possibly be found on some of the higher hills beyond Bagi.

149. ****Argynnis clara clara,** Blanchard.

A rare fritillary of the high inner hills. Several from the Baspa Valley, July '39, at 13,000′.

150. ****Argynnis eugenia mackinnoni,** De Nicéville.

A rare insect of the inner hills. Specimens from Shipki, 12,000′, and from the Baspa Valley, 13,000′, taken in July.

151. **Argynnis pales sipora,** Moore.

A scarce butterfly of the inner hills. We have specimens from the Rhotang Pass at 13,000′, caught in July.

152. **Argynnis lathonia issoea,** Doubleday.

Very common throughout the year in open country from 5,000′ to 15,000′.

153. **Melitaea arcesia sindura,** Moore.

Will be found chiefly at high elevations in the inner hills, though de Rhé Philipe reports one taken on the way to Kulu. Specimens from the Shipki neighbourhood, 14,000′, taken in July.

154. **Atella phalanta,** Drury.

A common autumn butterfly from the plains up to 9,000′. It may also be taken sparingly before the rains and in July.

155. **Ergolis merione tapestrina,** Moore.

May be taken occasionally in the Kalka neighbourhood after the rains. It does not penetrate far into the hills.

156. **Pareba vesta anomala,** Kollar.

Flies from about 2,000′ to at least 8,500′. It will be found to swarm in the bed of Shamri Nullah just above its junction with the Chota Simla stream, from the last week of June throughout most of July. Occasional specimens make their way up to Simla.

ERYCINIDAE

157. **Libythea lepita lepita,** Moore.

This butterfly is very common from April till the autumn. It will be found from about 3,500′ up to about 9,000′, wherever there is moisture.

158. **Libythea myrrha sanguinalis,** Fruhstorfer.

This species is not as common as the last but it may be taken frequently enough in damp nullahs during the same seasons and at the same altitudes.

159. **Dodona durga,** Kollar.

A common butterfly that will be found in lightly wooded spots from about 4,000′ to 8,000′ between the end of March and November.

160. **Dodona dipœa nostia,** Fruhstorfer.

A rare butterfly. We have a record of one taken at Potters' Hill, 6,500′, in June.

161. **Dodona eugenes eugenes,** Bates.

Considerably less common than *durga,* it prefers wooded nullahs and shady surroundings. It is common behind Jakko some years, and I have taken it in the nullahs on Tara Devi. It will be taken from May till the rains and again after them, above about 5,000′.

162. **Abisara echerius suffusa,** Moore.

May be taken occasionally in the Kalka neighbourhood before and during the rains.

LYCAENIDAE.

163. **†Castalius rosimon rosimon,** Fabricius.

A fairly common butterfly at the foot of the hills from spring to autumn. I have taken a specimen at 6,900′ in September, but it is very rare at such an altitude. It is a butterfly with a preference for forest glades and lightly wooded country.

164. **Tarucus venosus venosus,** Moore.

The members of this genus are generally found in fairly open country among the foothills and in the plains below them. Some of them may be taken as high up as Simla itself. *Venosus* is the commonest representative of the genus in our area up to about 4,000′, above that height it is rare. Season before and after the rains.

165. **Tarucus callinara,** Butler.

Much the least uncommon of the genus round Simla where one or two may be picked up every year up to at least 7,000′, between April and June and again in October. Lower down it is common and its season is more protracted.

166. **Tarucus extricatus,** Butler.

A scarce butterfly that can be picked up at the foot of the hills. We have a specimen taken at Chandigarh in October, but no other information.

167. ****Tarucus alteratus,** Moore.

A common butterfly from the plains up to about 4,500′ from June to October. Above that altitude it is rare.

168. ****Tarucus nigra,** Bethune Baker.

Not an uncommon butterfly in the lower valleys below about 4,000′ from June to October.

This is a confusing genus to identify and the specimens upon which we base our list were identified by Brigadier Evans.

169. **Syntarucus plinius,** Fabricius.

A common insect from the plains up to about 4,000′ from June to October. It may occasionally be taken in open country and gardens in Simla itself and even considerably further into the hills.

170. **†Azanus ubaldus,** Cramer.

In the low country where babul trees grow it is a fairly common insect before, during and after the rains. It may be taken occasionally in Simla itself. Specimens taken in Simla 24′5 ; 25·5, 6,800′.

171. **Azanus uranus,** Butler.

Will not be found quite so far into the hills as the last and may be taken during and after the rains.

172. ****Everes argiades indica,** Nov.

173. **Everes dipora,** Moore.

Both of these may be caught quite commonly in open country from early April until July and again after the rains. Of the two *dipora* is rather the commoner and they will both be taken from the foot of the hills to about 9,000′.

174. ****Everes parrhasius parrhasius,** Fabricius.

Its range is given by Evans as 'Ceylon . . . S. India' but it is interesting to note that Mr. Jones has specimens from Jubbulpore and Hardwar as well as Chandigarh, Kalka and Simla, in our area. It is not particularly uncommon even in the Simla neighbourhood, specimens having been taken up to 6,700′, between April and October.

175. **Lycaenopsis puspa gisca,** Fruhstorfer.

Rather scarce in Simla but found to be common at Koti, 3,000′, and presumably along the foot of the hills. It has been taken up to 10,000′. Season before and after the rains.

176. **Lycaenopsis vardhana,** Moore.

A common butterfly in the hills beyond Narkanda up to about 10,000′. Nearer Simla it is rather local and, though it has been taken as low as 6,000′, it is uncommon below 7,500′. It may be taken in plenty in the San Damiano nullah and on Kufri Hill. It likes lightly wooded surroundings and may be taken from May to the rains and again in September.

177. **Lycaenopsis albocoerulea,** Moore.

A rare hill species, especially here, the western edge of its limits. Records of captures between 6,000′ and 7,000′ in June, July and October.

178. **Lycaenopsis cardia dilecta,** Moore.

De Rhé Philipe mentions a capture near Kufri in October. We have no other information about this species.

179. **Lycaenopsis huegelii huegelii,** Moore.

180. ****Lycaenopsis ladonides gigas,** Hemming.

181. **Lycaenopsis argiolus kollari,** Westwood.

The females of these three butterflies are superficially very similar except in the matter of size and their habitat is the same . . . gardens, shrubs, hedges, etc. *huegelii* is extremely common, *ladonides* considerably less so. *argiolus* seems to prefer higher altitudes . . . the Kufri ridge and the top of Jakko are good places for it, though I have had it as low as 5,500′ and it probably can be caught considerably lower than that. The other two may be caught from about 3,000′ up to the height of Hutoo, 10,450′. Season for all three :— March to October.

Polyommatus vicrama vicrama, Moore.

Evans gives Shipki as a locality for this insect. Our specimens come from Purl, W. Thibet, a short way beyond, where it is apparently not rare. It may turn up on the Shipki Pass.

182 **Polyommatus astrarche,** Bergstrasser.

A fairly common butterfly from March until after the rains, it may be taken from the plains up to at least the height of Jakko, 8,000′, in open sunny places.

183. ***Polyommatus pheretes lehana,** Moore.

Not uncommon over 12,000′. We have specimens from the Shipki neighbourhood and the Baspa Valley taken in July.

184. ****Polyommatus omphisa,** Moore.

A fairly common butterfly of the higher hills above about 10,000′. Specimens from the Jalori Pass in July.

185. ****Polyommatus metallica metallica,** Felder.

A butterfly that may be taken above about 9,500′. Common in the Shipki neighbourhood in July. Also taken on Ganasi Dhar, 9,800′, in July.

186. **Polyommatus galathea galathea,** Blanchard.

Not uncommon in the inner hills above about 10,500′ in July. I also have a worn specimen taken as near to Simla as Sungri at 11,000′ in September.

187. ****Polyommatus orbitulus ellisi,** de Nicéville.

A rare blue of the inner hills. We have had it from Shipki and the S. W. borders of Thibet in July.

188. **Polyommatus eros ariana,** Moore.

Fairly common in the Shipki neighbourhood above about 8,000′ in July. A *Polyommatus* which seems to be mid-way between *ariana* and *dux* may be taken in the country between Mattiana and Sungri after the rains. Above 9,500′ it is by no means uncommon.

189. **Chilades laius laius,** Cramer.

May be taken from spring to autumn at the foot of the hills wherever the lime tree grows. We have records from Kalka and Chandigarh in October but it does not seem to be particularly common at that season. We have no records of its being taken further into the hills.

190. **†Zizeeria trochilus trochilus,** Freyer.

A fairly common butterfly at low elevations though likely to be overlooked on account of its minute size. It may be taken throughout the year in rough grass country such as all *Zizeeria* like. It can be caught up to 7,000′ though it is not common at that altitude. I have caught it at 6,900′ in Simla in October and November and have seen it at 5,500′ in February.

191. **Zizeeria maha maha,** Kollar.

During the warmer months of the year this is a very common butterfly at low elevations. Above 4,000′ it is common only from July to October though specimens may occasionally be caught before the rains.

192. **Zizeeria lysimon,** Hubner.

Fairly common at low elevations between April and October, it may be caught not uncommonly about the end of October up to 7,000′.

193. ***Zizeeria gaika,** Trimen.

May be taken occasionally at low elevations between April and October. We have a specimen from Chaba, 3,000′, in September and one from Simla, 6,000′, 20-9-39.

194. **Euchrysops cnejus,** Fabricius.

Like other members of this genus it will be caught in meadow country and about hedges and bushes. At low elevations it is common from April to October. It can be taken up to 8,500′ and in Simla it is by no means uncommon in September and October.

195. ****Euchrysops contracta contracta,** Butler.

Two specimens taken at B.C.P.S., 6,800′, 1-5-39 and 9-5-39 are the only records we have of the appearance of this butterfly in our district. It is more likely to be caught at plains level.

196. **†Euchrysops pandava pandava,** Horsfield.

Not very common at the foot of the hills, rare in Simla. We have captures from Chaba and Simla in September.

197. **Catachrysops strabo,** Fabricius.

Common in the plains and foothills but scarce in Simla, though it may be taken up to 10,000′. The season for this insect is July to October in Simla and February to late October at lower elevations. In Simla it is commoner after the rains.

198. **Lampides boeticus,** Linnaeus.

Very common to at least 10,000′. In Simla it may be taken from February to late November.

199. ***Jamides bochus bochus,** Cramer.

One specimen from Naldera, 6,500′, 27-9-37. No other record. One would expect to find this insect at low elevations in damp nullahs and flying round bushes, etc.

200. ***Nacaduba nora nora,** Felder.

This year I have taken about a dozen of these insects in the compound here, 6,800′, on different dates between the end of April and the beginning of the rains, so that one may presumably say that it is common even at this height. It is a very unobtrusive insect and so possibly escapes notice. At lower elevations it is doubtless commoner and may be taken from early spring to late autumn. Here it may be taken again after the rains. It will not be found much above 7,000′.

201. **Lycaena pavana,** Kollar.

Very common early spring to late autumn, from about 5,000′, in open, sunny places.

202. **Lycaena phloeas indicus,** Evans.

203. **Lycaena phloeas flavens,** Ford.

Very common early spring to late autumn; *indicus* will be found above about 5,000′, and *flavens* in the inner ranges Shipki way, though intermediate specimens will be found in the country between.

204. **Lycaena kasyapa,** Moore.

We have no records of this butterfly having been taken any nearer than Lahoul and Shipki in July, although de Nicéville mentions a capture on the Thibet Road near Simla. It may be found in the Bagi country above 8,000′ in open places in the forest in the summer.

205. **Heliophorus sena,** Kollar.

Very common anywhere the sorrel plant grows . . . from about 4,000′ to 8,000′. Early spring to October.

206. **Heliophorus oda,** Hewitson.

This beautiful little blue is rather local and will not often be taken below about 7,500′, though I once took a very worn female in a nullah below B.C.S. at 5,400′, in late March. It may be taken in fair numbers in the San Damiano nullah between about the 10th of May and the 1st of June. The bushes at the roadside between the rest-house and the bazaar at Kufri are another profitable locality. On June 4th I found it common flying around the bushes beside the mule track on Ganasi Dhar, 9,800′.

Heliophorus bakeri, Evans.

This has not yet been taken in the district, but it is included on the grounds that, though Evans gives its locality as Chitral . . . Dalhousie, it has since been taken in Nepal. It would be taken in similar places to oda, *which it resembles.*

207. **Heliophorus androcles coruscans,** Moore.

A rather uncommon butterfly that may be taken in the nullahs on the Mahasu ridge, on Kufri Hill and in Simla in June and September.

208. ***Strymon sassanides,** Kollar.

An uncommon butterfly of the inner hills. Specimen from Spiti at 12,000′, in July.

209. ***Euaspa milionia,** Hewitson.

A distinctly rare little butterfly. It will be taken in damp nullahs just before the rains. Specimens from the nullah just below the Walker Hospital 5·6., the Glen 24·5., and the nullah between Chota Simla and the Convent.

210. **Thecla icana,** Moore.

Members of this genus are generally caught in nullahs and glades in forest country. Very occasionally *icana* may be taken on Kufri Hill, on the Jalori Pass and in the Narkanda . . . Bagi country where in places it is not rare. I have taken specimens on the road between Bagi and Khadrala in September among swarms of *Thecla syla*. This, I should imagine, is as good a spot as any for this insect. It flies in August and just after the rains.

211. **Thecla bieti dohertyi,** de Nicéville.

May be caught in the same localities and at the same seasons as the last. Round Narkanda it is not particularly uncommon.

212. **Thecla ataxus ataxus,** Doubleday.

A rare butterfly. We have taken it in the San Damiano Nullah and in the nullah between Chota Simla and the Convent at the end of May.

213. **Thecla birupa,** Moore.

Simla is the western limit of this butterfly and it is rare here. We have had it in the nullah between Chota Simla and the Convent, 7,000′, and in the nullahs on the north-western slopes of Tara Devi. It has also been taken on Kufri Hill. It has been observed flying round holly trees.

214. **Thecla syla syla,** Kollar.

A very common insect in damp nullahs and glades wherever there are oak trees above about 7,000′. It will be taken from early May until the rains and again directly after them.

215. **Chaetoprocta odata,** Hewitson.

Is common round walnut trees in early June. It may be taken from about 4,500′ up to the Chini district.

216. ***Curetis acuta dentata,** Moore.

Rare in our district and most likely to be taken in the lower valleys, though I caught a female on May the twenty-third of 1938 in the compound here, 6,800′. Specimens from Chaba in October, and Koti in September.

217. **Iraota timoleon timoleon,** Stoll.

Rare in this district. Several specimens taken in early June at 6,000′. Specimens; female, Chaba 3,000′ . . . male, Summerhill 6,500′ . . . male, Simla, 6,000′. Mainly a low elevation insect.

218. ****Amblypodia alemon,** de Nicéville.

One specimen taken in early June in the San Damiano Nullah, 7,500′. This will be the western limit of this butterfly's range and it will be very rare.

219. **Amblypodia dodonœa,** Moore.

220. **Amblypodia rama rama,** Kollar.

221. **Amblypodia ganesa ganesa,** Moore.

These three butterflies may be caught from early May until the rains and again in August until late October. They are very common, especially before the rains, in damp nullahs in oak forest.

222. **Surendra quercetorum quercetorum,** Moore.

Rare. We have several specimens taken 31·7., Koti, 3,000′. It is a low elevation butterfly and will be taken in jungle country.

223. **Apharitis lilacinus,** Moore.

Rather an uncommon butterfly that will be taken at the foot of the hills. We have several specimens taken at Chandigarh in April and October. It seems to have a liking for gram fields.

224. **Spindasis vulcanus vulcanus,** Fabricius.

Not uncommon in the lower hills and the plains at their foot. At low elevations it may be caught from March to July and again after the rains. It will also occasionally be taken in Simla and even up to Mashobra, just before the rains and in October.

225. ***Spindasis ictis ictis,** Hewitson.

Rather uncommon in the plains and it does not extend into the hills. Specimens from Chandigarh between March and July and in October.

226. **Spindasis elima uniformis,** Moore.

De Rhé Philipe mentions a capture on the Chail ridge in June. No other information.

227. **Spindasis nipalicus nipalicus,** Moore.

Not particularly uncommon in the plains and foothills of our district, it may occasionally be taken round Simla. Specimens:—two 26·5, 6,000′, in the nullah below the Grand Hotel, . . . one at the end of May taken in the Glen, 6,000′, . . . one in September from Chaba.

228. **Pratapa icetas icetas,** Hewitson.

A rare butterfly that will be taken in wooded country up to about 8,500′. It has been taken on Kufri Hill and we have records from Chadwick Falls, 6,500′, and Simla, 7,000′, all at the beginning of June. It is mainly a low elevation butterfly.

229 ****Pratapa cleobis,** Godman.

Very rare. This is the extreme western limit of its area. It is a low elevation butterfly and we have a specimen from Chaba, 3,000′, 22·10.

230. ****Tajuria diaeus,** Hewitson.

Simla is also the western limit of this butterfly and it will be very rare. Also a low elevation insect. Specimens from the Glen, 6,000′, and Tutikandi, 6,500′, in May.

231. ***Tajuria cippus cippus,** Fabricius.

Mainly a butterfly of the eastern Himalayas and Burma, it is rare here and will mostly be caught at low elevations. All our specimens have been taken after the rains. Chaba, 3,000′, 22·9 . . . Elysium Spur, 7,000′, 3·9 . . . Simla, 6,000′, 12·10.

232. **Horaga onyx onyx,** Moore.

A rare insect that may occasionally be taken from low elevations up to 7,000′, shortly before the rains and in September. Specimens:—B.C.P.S., 6,800′, 22-5-38 . . . Near Junga, 4,000′, May . . . Chaba, 3,000′, September.

Horaga viola, Moore.

A rare species that extends from Kangra to Kumaon. No record of its capture.

233. **Deudoryx epijarbas ancus,** Fruhstorfer.

Not uncommon in June and July, it will often be taken settling on flowers. It should be looked for also where the pomegranate grows as the larvae feed inside the fruit. At this altitude, however, the larvae feed inside the horse-chestnut.

234. ****Virachola isocrates,** Fabricius.

A rare insect at this height, it is more likely to be taken at low altitudes in May, September and October in the neighbourhood of guava plantations. Specimens from Chaba, 3,000′, in May, Koti, 3,000′, in September, and a perfect female at B.C.P.S., 6,800′, 20-10-38.

235. **Virachola perse perse,** Hewitson.

Its range is given as Kangra to Burma. It must be very rare and we have no record of it apart from de Rhé Philipe's mention of a capture somewhere near Kalka. Guava plantations at lower altitudes are the most likely places to take it.

Rapala varuna grisea, Moore.

Recorded limits, Kangra to Kumaon. No records.

236. ****Rapala schistacea,** Moore.

A rare insect and the only one that we know of that has been caught in our region is one taken for me on buddleia blossoms at B.C.S., 6,500′, in the middle of June. It is more likely to be caught at low elevations.

237. ***Rapala melampus,** Cramer.

Rather uncommon, it may be taken from plains level to 10,000′, just before the rains and in September and October.

238. **Rapala nissa nissa,** Kollar.

The only representative of this genus in our area that is common. It will be found from the end of April until just after the beginning of the rains. It is partial to damp nullahs and is also to be found flying round bushes and settling on flowers.

239. **Rapala micans selira,** Moore.

Usually not a common insect but this year it was to be had in plenty. I caught as many as I needed flying round flowers in the compound here, and saw a number of others about bushes between the Dhali filter beds and Mashobra, and settling on damp ground in the San Damiano nullah. It will be taken from the beginning to the end of May from about 5,500′ to 8,500′.

240. ****Rapala extensa,** Evans.

One specimen from Spiti, 12,000′, in August. This is rather far east for this butterfly.

241. ***Sinthusa chandrana chandrana,** Moore.

A rare butterfly that will be taken in late May and June above about 4,500′. Records from the Junga neighbourhood at 4,500′ and 5,000′, 30·5 and 15·6.

Sinthusa nasaka pallidior, Fruhstorfer.

Given by Evans as extending from Kangra to Kumaon. No record.

Hesperiidae.

242. **†Hasora alexis alexis,** Fabricius.

One of the commoner of our skippers, I have frequently taken it settling on buddleia flowers between late June and September. It will be found from plains level to 7,000′.

243. ****Ismene jaina jaina,** Moore.

This is the western extreme for this butterfly so it is very rare. It will not be caught much above 3,500′ and our only records are of one or two that were taken near Chaba at 3,000′, 5·9.

244. ***Bibasis sena sena,** Moore.

Again this is the western edge of this butterfly's limits. It is uncommon throughout its range and anyone who catches it in our area is very fortunate. Like the last-mentioned species it is a low elevation butterfly. One record from Chaba, 3,000′, at the same date as the last.

245. **†Choaspes benjaminii xanthropogon,** Kollar.

This fine insect is a rarity here and is most likely to be taken at this altitude from the beginning of May to June. We have records from the San Damiano nullah, 14·5, and the Chadwick Falls nullah 25·5; de Rhe′ Philipe also mentions having taken it at Koti in June. It is worth noting that, though it flies in the early morning, it does not do so exclusively, the first two mentioned specimens being caught at about mid-day. It ranges from fairly low elevations to about 8,000′.

246. **Badamia exclamationis,** Fabricius.

Not uncommon from the plains up to about 7,000′. Up here it will be seen from late June till August. I have caught all my specimens on buddleia blossom.

247. ***Celaenorrhinus pulomaya,** Moore.

Very rare here. One specimen from Kalka taken in May at 2,000′.

248. **Celaenorrhinus leucocera leucocera,** Kollar.

One of the commoner skippers about Simla, it may be caught from about 4,000′ to 8,000′ from April to July. It seems to prefer damp, shady places and most of my specimens have been caught near water on bushes. Shamri nullah in April and May is usually a good spot for this butterfly.

249. ***Celaenorrhinus munda,** Moore.

We have no reliable record of the appearance of this butterfly within our limits. It is very similar to *leucocera* and might easily be mistaken for it in flight. I have one specimen in my collection. This is a relic of an old school collection that was handed over to me when I first arrived here and the insect in question bore unmistakable signs of having been set by a boy . . . so it most probably was caught in the neighbourhood of the school . . .this is the nearest approach to any record we have got.

250. ***Achalarus bifasciatus casyapa,** Moore.

A rare butterfly that may occasionally be caught above about 6,000′. We have two records of insects taken in June, one on the Elysium Hill at 6,700′ and the other in the nullah below the old toll bar on the Mashobra road,

251. **Tagiades menaka,** Moore.

Not particularly uncommon in damp shady nullahs during May and June from low elevations to about 7,000′. It is given to settling flat on the undersides of leaves which makes it rather difficult to spot. I have also caught it on flowers. Chadwick Falls is a good neighbourhood for taking it and I have also seen it in the nullah between Chota Simla and the Convent.

252. ****Tagiades litigiosa litigiosa,** Moore.

May be taken in the same places and at the same seasons as the last-mentioned which it greatly resembles. However, it is a much less common insect. Recorded from the nullah below the Grand Hotel, 6,000′, October, and Chadwick Falls nullah, 6,000′, April.

253. **Coladenia dan fatih,** Kollar.

Not uncommon from the plains up to about 7,000′. It likes damp, shady places but it also comes to flowers in gardens. Late June, July and August is the season in Simla, but we have specimens taken in September and October at 3,000′.

254. ***Sarangesa purendra,** Moore.

255. **Sarangesa dasahara dasahara,** Moore.

These are two unobtrusive little insects that are likely to be overlooked. Their home is the scrubby jungle country at the foot of the hills, though they may be taken in open, grassy country up to 7,000′. Neither of them is at all common though *purendra* would seem to be the commoner of the two. We have taken at *dasahara* B.C.P.S., 6,800′, 30-4-39 and another at a low elevation in October. We have taken *purendra* from July to October up to 6,500′.

256. ***Odontoptilum angulata sura,** Felder.

An uncommon butterfly in these parts, it is mainly an inhabitant of the lower regions, though it has been caught on Kufri Hill at 8,000′. Season: spring and autumn. Specimens: Kufri Hill, 8,000′, in June; Chaba, 3,000′, in September.

257. **Syrichthus galba,** Fabricius.

Flies from spring to autumn in the grassy country at the foot of the hills but is not at all common in this part of India. It penetrates the lower valleys up to about 5,000′. Specimens: Chaba, 3,000′ in September; Kalka, 2,000′, in October; Shalogra, 4,000′ in July; Shamri Nullah, 4,900′ in October.

258. ***Aeromachus stigmata,** Moore.

An undistinguished-looking little skipper that is rare here. It seems to keep to damp nullahs and flies before and after the rains. Records: Chadwick Falls nullah, 6,000′, 10·6; near Junga Bridge, 4,500′, in September; below the settling tanks on the Chota Simla . . . Kasumpti stream in July and September.

Pedestes masuriensis, de Nicéville.

Recorded between Kulu and Assam. No records.

259. **Suastus gremius gremius,** Fabricius.

Fairly common at low elevations after the rains, probably in the neighbourhood of palm trees, it may be taken occasionally up to 7,000′. Records: Simla, 7,000′, and Chandigarh, 2,000′, both in October.

260. **Udaspes folus,** Cramer.

A largish, striking-looking skipper that is found from the plains up to about 7,000′. It is not common and flies in April and May. I have noticed it settling on dung.

261. **Notocrypta feisthamelii alysos,** Moore.

A local insect. Once the right spot has been found plenty may be taken. This year I found them in good numbers in the nullah between Chota Simla and the Convent where I caught a number of specimens. I noticed them also about the same time in the San Damiano nullah. This was during the third and fourth weeks of May, but they can also be caught in July and after the rains, though less commonly. They seem to like flying in the shade in nullahs where there is water, but they also come to flowers occasionally. They are very difficult to see in flight but they have a habit of settling on stones to which they return time and time again.

Hyarotis adrastus praba, Moore.

Range: Kangra to Burma. No record. A low elevation insect.

262. ***Actinor radians,** Moore.

Rare throughout its range. Flies from about 2,000′ to 5,000′. Specimens from Chandigarh, 2,000′, in October and Kulu, 4,500′, in August.

263. **Taractrocera danna,** Moore.

A common little insect in open, grassy country from the Mahasu ridge well into the hills. It does not often come below 7,000′ and I have noticed numbers of them settling in the dust on the Hindustan . . . Thibet road beyond Mattiana. Season from early May until about the end of June.

264. ***Taractrocera maevius sagara,** Moore.

Not uncommon below about 5,000′ in the same sort of country as the last. It will appear during most of the warmer months. We have had it from Kalka, 2,000′, in April.

265. **Padraona dara,** Kollar.

Flies about bushes and flowers. Not rare above 6,000′ from May to October.

266. ****Padraona cato clio,** nov.

Fairly common below 6,000′. It is very similar in appearance to the last-mentioned and its habits and seasons are the same. We have it from Chaba, 3,000′, in August and September.

267. ****Astycus augias augias,** Linnaeus.

Very rare here. One specimen from Chandigarh, 2,000′, in October.

Pamphila comma indicofusca, Verity.

Pamphila comma dimila, Moore.

Two high elevation insects about which we have no information. The range of the former is given as Chitral to Kumaon, and the latter as Bashahr to Kumaon.

268. ****Baoris eltola,** Hewitson.

Not uncommon from about 5,500′ well into the hills to about 10,500′. Like other members of the genus it is given to settling on flowers. It may be caught in May, September, October and occasionally during the rains.

269. **Baoris discreta himalaya,** Evans.

A hill species that does not seem to be at all common here. Records from Simla at 6,500′ in March and at 6,000′ in July.

270. **Baoris sinensis sinensis,** Mab.

Not rare. We have records of specimens caught in mid-April, June and July all at 7,000′ and I believe it is a post-monsoon species as well. Mahasu is reputed to be a good spot for this insect.

271. ***Baoris mathias mathias,** Fabricius.

A low elevation skipper which is fairly common in the Kalka . . . Chandigarh and Chaba districts. Our specimens are dated September and October but it will be on the wing during most of the warmer months of the year.

272. **Baoris guttatus guttatus,** Bremer,

273. **Baoris guttatus bada,** Moore.

The hill form, *guttatus guttatus,* will be found well into the hills . . . I have had it at Sungri, 8,500′. It is quite common in September and October when it will often be seen darting about flowers. *Bada* the low elevation form, will be caught at the same season up to 7,000′ but it is not nearly as common. We have specimens taken in Simla at 7,000′ in September and October.

274. **Baoris zelleri cinnara,** Wallace.

We have no record of this species ourselves, but de Rhé Philipe mentions having caught one in Simla. It is more likely to be taken in the Kalka country.

275. **Baoris bevani bevani,** Moore.

Quite common from the plains up to 7,000′, it appears in April and early May round Simla but will be caught after the rains at low elevations . . . we have it from Chaba, 3,000′, in September. I have caught it settling on mud in Shamri Nullah and also flying about flowers in the garden here.

276. ***Gegenes nostradamus karsana,** Moore.

Not common but will occasionally be caught at low elevations during and after the rains. Specimens from Chaba, 3,000′, and Koti, 3,000′, in July, August and September.

ADDENDA

LYCAENIDAE.

277. ***Zizeeria otis otis,** Fabricius.

Common up to 7,000′ at the end of October and beginning of November.

NYMPHALIDAE.

278. ***Neptis narayana narayana,** Moore.

A rare and very local insect which is out for a short time just before the rains. It may be caught in the nullah between Chota, Simla and the Convent and I have seen it near Theog, mile 20/5, Tibet road.

A REPTILE AND AMPHIBIAN MISCELLANY.

BY

CHARLES McCANN, F.L.S.

PART I

(*With 9 plates and 3 text-figures*).

INTRODUCTION.

This paper is an attempt at grouping together in a presentable form many of my notes and field observations on Reptiles and Amphibians. It covers a period of many years of intermittent field study. Much of the information relates to animals met with in the vicinity of the islands of Bombay and Salsette, but observations made further afield have also been incorporated. Whenever possible, an endeavour has been made to record the findings photographically.

HIBERNATION AND AESTIVATION.

It is well known that the temperature of reptiles varies with the temperature of the atmosphere and also its humidity. The fluctuation of the climatic conditions increases or retards activity; thus it is that we find that certain animals 'disappear' during certain seasons and 'reappear' at others. In the case of lizards, for example, heat is responsible for greater activity, except when too severe; while cold on the other hand, retards their activity and forces them to seek shelter. Amphibious animals, such as crocodiles, turtles and frogs, are less influenced by atmospheric changes, and are largely dependent on water supply; but land tortoises react in the same way as lizards to atmospheric conditions. Frogs are dependant on water supply and humidity of the air, hence it is we find that most frogs aestivate during the dry weather but some move about during this period under the cover of darkness when evaporation is low. Frogs can stand a good deal more cold, provided it is not dry, than lizards.

REPRODUCTIVE ORGANS.

In the female, a pair of ovaries is present and both become functional only during the breeding season. The mass of embryonic eggs, when visible, appear as small creamy, spherical bodies situated near the middle of the body on either side of the vertebral column. The number of ova varies considerably in the different families and in some instances with the species, from but a few in the Hemidactyls, to several hundred in many of the Ranids. In the breeding season the ova exhibit all stages of development, from the microscopical to the mature. The ova that do not mature in anyone season undergo a process of resorption as in the case of birds, and the whole genital system undergoes complete reduction, often making it really difficult to sex an animal from a casual survey.

During the breeding season, the whole oviduct is in a state of *hypertrophic turgescence,* i.e. it is much enlarged. This condition is clearly seen in the photograph illustrating the difference between the breeding and non-breeding condition of the ovaries in the Marsh Crocodile (Pl. II). The genitals of immature, non-breeding animals also show a certain amount of enlargement during the general breeding season, but not, by any means, to the same extent as those of breeding animals. This is well illustrated in the photograph of the Bull-Frogs (*R. tigrina*) which appears in part II of this paper. In the non-breeding period the genitals are so reduced, that in many cases, it is difficult indeed to sex a specimen.

Like the ovaries the male organs are paired and both become functional during the breeding season. The seminal ducts lead into the cloaca. In crocodiles, turtles and tortoises there is a single extrusible copulatory organ; in lizards and snakes it is a paired process; while in frogs and toads no such organ exists. Fertilization is external in frogs and toads and generally takes place in water.

ORDER: LORICATA.

FAMILY: *Crocodilidae.*

Crocodilus palustris Lesson. The Marsh Crocodile or Muggar.

The Marsh Crocodile (*C. palustris*) I have met in several parts of its range: in Sind, along the banks of the Indus River and canals, and also in some of the lakes; in the United Provinces, in the marshes of the Gola (Kheri Dist.); in Rajputana, along the bed of the Banas River; and in the Bombay Presidency—Tapti River, Salsette Island, and the Kala Nuddi, Kanara. I have also visited the famous 'Muggar Pir', near Karachi, where the animals are kept in a small area enclosed by a wall.

In spite of its size, the muggar is an extremely shy animal whose senses of hearing, sight and smell are highly developed; it is difficult of approach, and only a 'sleeping' individual may sometimes be taken by surprise. Though, generally speaking, the muggar is an inhabitant of sweetwater, in the lakes near Tatta, Sind, it is found in water so saline as to be undrinkable. The hillsides bordering some of these lakes show distinct traces of 'crocodile paths' leading up from the water. I followed up some of these; the ascent was often steep, with a lot of loose sand and stones. The 'paths' invariably terminated in a large deep hole in the hillside, evidently the work of a crocodile. The entrance was often two feet or more in diameter. The burrow descended for some 8-15 feet terminating in a large chamber, sufficiently wide to allow the animal to turn round and lie comfortably. In one of the burrows a ten-foot crocodile was at home! Though an unsporting thing to do, I shot the beast. Being June, the usual breeding season, I examined the burrow for eggs, but there were none. It would appear that these burrows are just retreats in which the animals spend the hottest part of the day.

When hit by the first bullet, the brute lashed out furiously with its tail and created an awful dust within the burrow, at the same time 'roaring' loudly. The noise can only be compared to the roll of a big-drum. Apart from this sound, muggar hiss loudly and make a clapping noise by snapping the jaws together. When cornered they face the enemy with open mouth, the tail ready to strike, and the snapping is often repeated. When attacking, they may jump slightly forward (more true of the young) with the mouth open in an endeavour to bite, or they may bring the tail round with a powerful sweep towards the head, and the head moved inwards towards the tail. When an object is gripped between the powerful jaws it is 'dusted' by vigorous shaking of the head.

While sailing down the Indus towards the sea from Baggarh, I often saw large numbers of these huge reptiles lying on the muddy banks, and presenting the appearance of a timber curing yard; there must have been well over a hundred in some places, basking in the sun, motionless, yet ever ready to plunge into the river on the slightest suspicion of danger. They were seen at all hours of the day. Once I had the opportunity of seeing one make a meal. As our boat passed close to the bank, I noticed the water was much disturbed in the shallows. Suddenly, out jumped a fish about two feet long on to the bank. No sooner had this happened, than a crocodile broke the surface and followed the fish to the bank, caught it, swallowed it—head first, and then disappeared into the river.

In the Gola, Kheri District, crocodiles are numerous in the swamps. The marshes, during the cold season, form large expanses of water surrounded by tall grass, often twelve feet or more high. On the banks crocodiles make definite paths to the spots where they lie up. In such places one may sometimes surprise a 'crock'. Its first impulse on the slightest sign of danger is to get back into the water and disappear, only to show the top of its head some distance off as it drifts gently away without causing a ripple. The marshes are also the home of Swamp Deer and Pythons; and during the winter months they are visited by hundreds of duck and other wild fowl. In this area the crocodiles probably feed largely on wild fowl and Swamp Deer.

In the Banas river (Rajputana), which is dry for several months of the year soon after the rains, the crocodiles tenant some of the large and deep pools left along the bed of the river and some of the permanent pools in the neighbourhood. During floods they travel a long way up and down stream.

The *Fauna*[1], with regard to the basking of crocodiles states: 'They do not leave the water until the sun is well up, and return to it before the sun has set.' My experience is that they come out much at night. I have shot them at all hours of the night on banks with the aid of a torch. In the Bombay Municipal lakes of Tulsi, Vihar and Powai on the island of Salsette, crocodiles are frequently seen. In these areas I have found them lying upon the banks both during the day and during the night.

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[1] *F. B. Ind.* (*Reptilia*), vol. i, p. 36, 1931, 2nd edn.

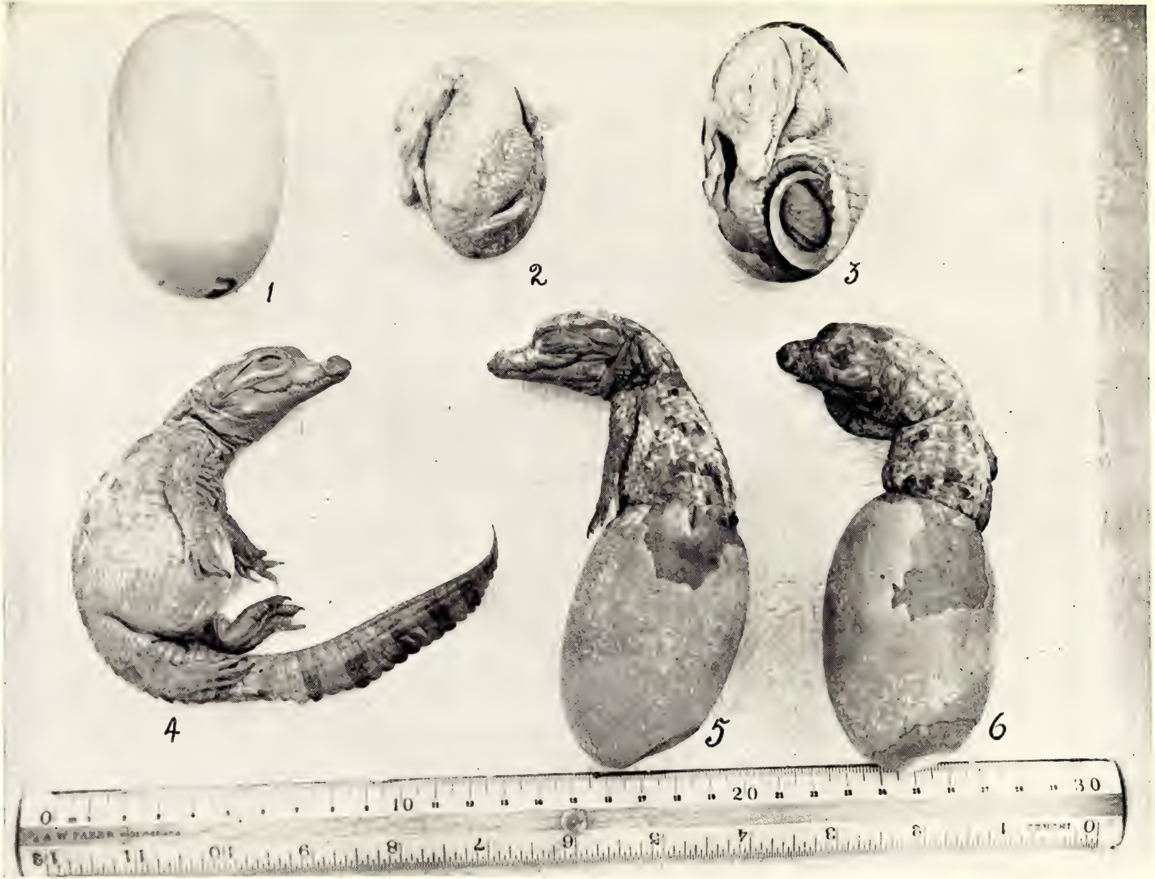

Photo: C. *McCann.*

Crocodilus palustris Lesson.

1, 4, 5, 6. Chanda specimens of the same clutch.
2. Tulsi Lake.
3. (?).

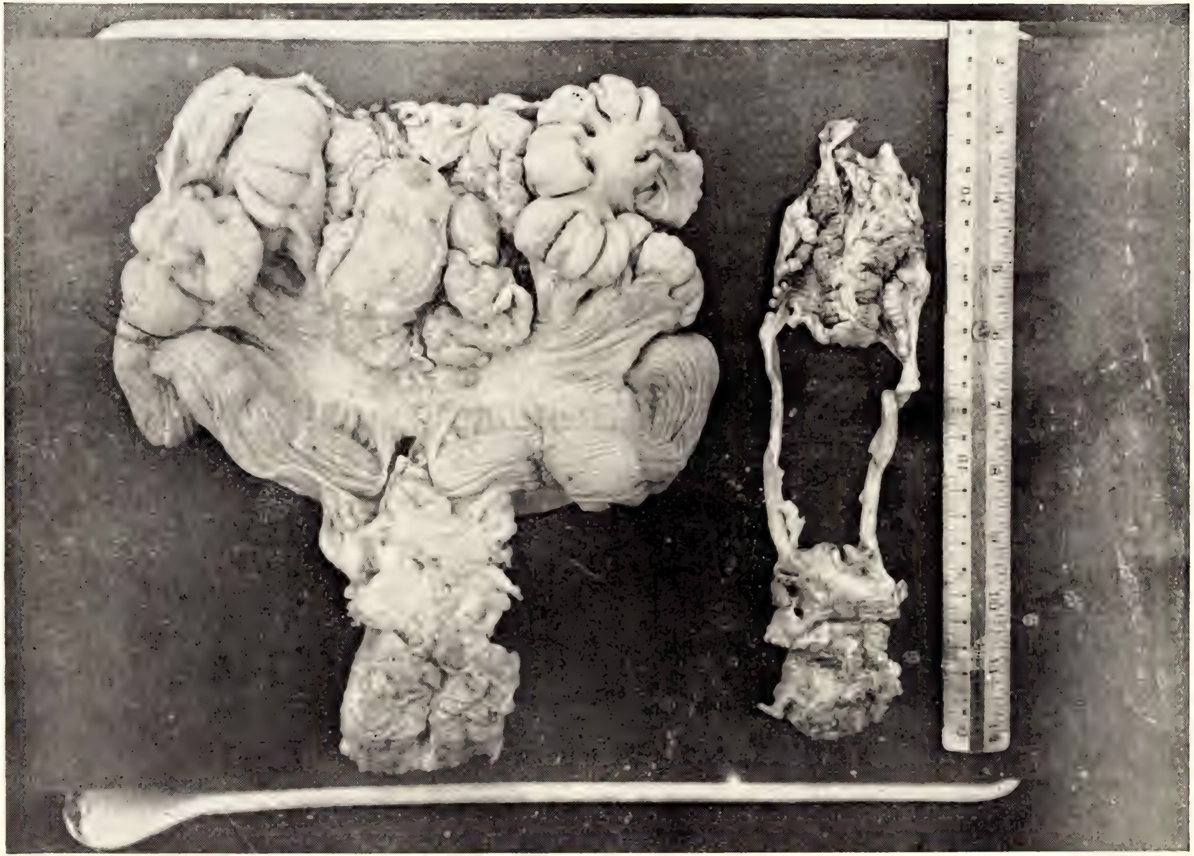

Photo: C. McCann.

Female genital systems of the Marsh Crocodile (*Crocodilus palustris* Lesson), showing the difference between active and non-active genitals at the breeding season.

This crocodile is a very nasty-tempered reptile; even after weeks and months of captivity it still remains savage. All attempts to 'tame' them generally resulted in a lacerated finger or hand, though they recognised well the feeding time and the food and readily came for it, but any attempt at familiarity was immediately resented. When in water the food is easily caught and swallowed, but picking food off the floor is a difficult process as the meat has to be seized with the side of the jaws.

Young.—Recently I had the opportunity of examining four preserved specimens of hatching crocodiles sent in to the Society by the Divisional Forest Officer of North Chanda, Central Provinces. Two of the four specimens were half out of the egg, one out, and one still in the egg. Two of the eggs measured 79×50 mm. and 80×50 mm. respectively, and the hatchling 294 mm. from tip of snout to tip of tail (over the back). The same animal measured with dividers, from tip of snout to vent 118 mm., from vent to tip of tail 132 mm. (=250 mm.). The latter measurement agrees with that given in the *Fauna* (p. 48). Besides the Chanda specimens there are a few small specimens in the society's collection; of these only one has still its egg-tooth. This specimen measured 283 mm. over the back. All the Chanda specimens exhibit the egg-tooth clearly. The egg-tooth is a small wedge-shaped calcareous point attached to the rostrum shield. The egg is invariably ruptured at one of its poles.

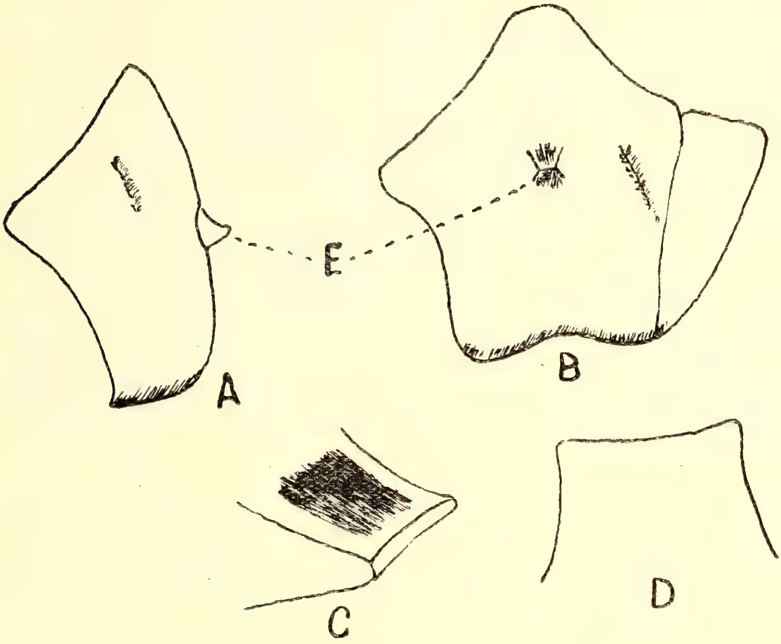

Fig. 1.—Egg-tooth of *Crocodilus palustris*.

A. & B. lateral and front view of egg-tooth on the rostrum.
C. & D. outline of egg-tooth.

Breeding.—Crocodiles breed regularly in the municipal lakes in Salsette Island. On the 20th April 1940 Mr. Humayun Ali gave me three eggs which had been taken about a week previously. These eggs were fairly new. On the 3rd May 1939 Mr. Ali brought me two specimens shot by him in the Powai Lake, Salsette. One measured 6 ft. 4 in., the other 5 ft. 4 in., both females. Dissection clearly showed that the former was just entering on the breeding season. The ovaries were considerably enlarged and contained some large ova, while the oviducts had become considerably distended and elongated, obvious indications that the animal was about to breed. The other, on the other hand, showed no signs of genital activity; the ovaries and oviducts were small and undeveloped (Pl. II). On the 13 June (1940) I shot two specimens, one a female, measuring 6 ft. 5½ in., and the other a male 4 ft. 9 in. Examination of the genitals indicated that the female had laid eggs some time back. The ovaries were undergoing resorption and contained no large ova. The oviducts, though still considerably enlarged, were now contracting. The genitals of the male were still immature. Does this then give us the approximate size at which the females of this species reach sexual maturity?

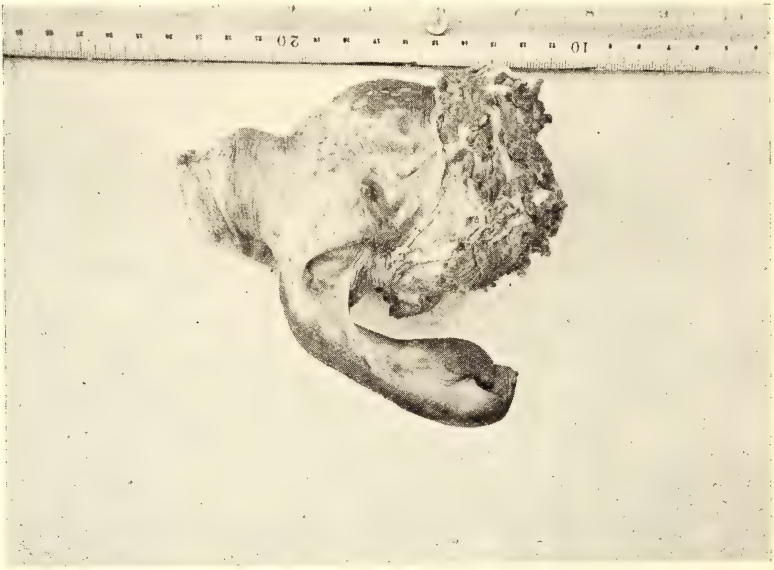

Fig. 2.—Copulatory organ of *Crocodilus palustris* Lesson.

Growth.—Gadow[1] referring to the age at which crocodiles become sexually mature writes: 'They are capable of propagation long before they are anything like half-grown, may be at the age of little more than ten years'. If this observation is correct, and if we accept the average annual growth (*Fauna,* p. 35), a sexually mature animal should measure approximately 100 inches (=8 ft. 4 in). In the present instance the animal is only 6 ft. 4 in., estimating its age by the same standard of growth, it would be only 7½ years

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[1] *Cam. Nat. Hist. Series* (Amphibia and Reptilia) p. 448.

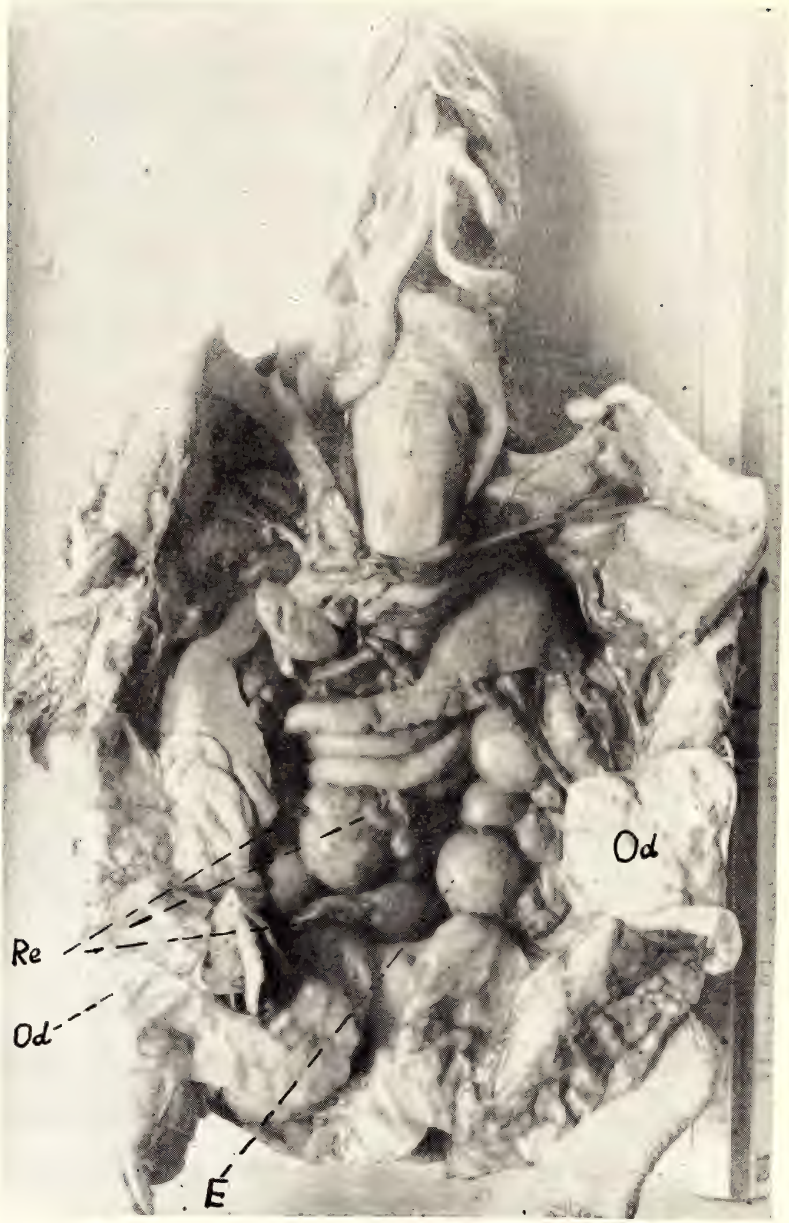

Photo: *C. McCann.*

A gravid Pond Turtle [*Lissemys punctata granosa* (Schoepff.)]
E. eggs; Re. Ruptured eggs; Od. Oviduct.

old. However, with reptiles, I think, it is perhaps better to arrive at the size at which they breed rather than place any reliance on age.

The very young generally leave the lakes and live in the neighbouring pools and streams during the rains, but return to the lakes when the water in the surrounding country dries up.

Food.—In volume xxxviii, p. 409 of the *Journal* I referred to the diet of the Salsette Crocodiles. In Salsette these animals appear to feed largely on aquatic beetles, *Cybister* spp., *Hydrophyllus* spp., such fish as they can catch, and the giant water-bug, *Belastoma indica Sep. et Serv.* To this must be added numerous snails. The process of digestion devolves on numerous small stones, some of them as much as an inch in diameter, which are always present in the stomach. An examination of the stomach contents of the two animals shot on the 13 June revealed that the stomach of the larger one was empty except for a number of stones. In the smaller there was an entire carp (*Barbus chrysopoma* Cuv. & Val.) about 10 in. long, in a partially decomposed state and a complement of stones. The size of the stones apparently vary with the size of the animals. The larger beast contained stones some of which were slightly over an inch in diameter, while those in the stomach of the smaller, barely exceeding half an inch.

ORDER: TESTUDINES: Tortoises, Turtles and Terapins.

FAMILY: *Trionychidae*: Soft-shelled Turtles.

Lissemys punctata granosa (Schoepff.). The Pond Turtle.

During the rains both the adults and young of the Pond Turtle (*L. p. granosa*) often cover considerable distances at night moving from one tank to another. Though the gait on land is far from graceful, this animal can travel comparatively fast. Flooded fields are often halfway stops. The young appear in fields and small pools later in the season.

On the night of the 5th August 1937 my cook brought me a large female, which had wandered into our compound at Andheri, Salsette. The carapace measured 212×149 mm., plastron 200×160 mm. (The plastron was measured after its removal, flat.). The turtle was evidently on its way from one tank to another. The two closest tanks to my bungalow, one to the west and the other to the north, are about a mile and three-quarters of a mile respectively. This meant that the animal would have had to travel approximately two miles. When captured it was unhurt and showed no signs of injury. I placed it along with some other tortoises in a wire enclosure. Next morning, to my surprise, the animal was in a precarious condition, and it died a couple of hours later. On dissection it was found to be gravid. It contained ten eggs, the three largest of which had burst, the contents overflowing the body cavity. It had evidently climbed up the mesh of the enclosure in an effort to escape, and dropped down several times with this fatal result. Numerous other ova at various stages of development were present in the ovaries, the largest of these measuring 24 mm. in diameter. The oviducts were considerably dilated but contained no eggs.

Eggs.—This species is accredited with laying 10-12 eggs at one time, but there appears to be the possibility that further clutches are laid by the same individual at different intervals, as indicated by the presence of a 'surplus' number of eggs. This, however, is a mere surmise, because we know that in the case of birds 'surplus' ova are absorbed during the non-breeding season.

The eggs are spherical and hard-shelled. They are laid in soft mud not far below the surface. The time of deposition has not been definitely ascertained, but the newly hatched turtles appear late during the season. The eggs are presumably laid and hatched during the rains. On March 28, 1939 Rev. T. Williams of Balaghat District sent a couple of eggs of the Pond Turtle for identification. Referring to the circumstances under which they were found Rev. Williams wrote, 'A few days ago while having some earth dug out of the tank close to my bungalow a clutch of eight eggs was unearthed by the coolies.' The eggs seemed to be quite fresh as there were no signs of incubation or decomposition. One of the eggs measured 28 mm. across, the other was broken.

Growth.—Growth is, at first, fairly rapid, and newly hatched young are not seen after the rains. As the pools dry, the young wander to larger and more lasting expanses of water which only dry up in the hot weather or a little before, so that the aestivating period in many instances is not a long one. Turtles do not aestivate when water is perennial, and under such conditions are often seen basking on rocks and vegetation, but on the slightest suspicion of danger disappear into the water.

Food.—The food of this turtle consists mostly of frogs and water plants, in fact one may safely say it is omnivorous. In captivity the animals feed readily on raw meat and bread. The food is held in the mouth and torn to bits by the sharp claws. During the process, both forelegs are brought up together to bear upon the food, sometimes alternately. Though generally voracious feeders, they are able to survive considerable periods of starvation. One I had in captivity refused food for nearly two years after it had been captured. After this long period, the animal, which had been living in a water tank, died. Externally it showed barely any signs of its long fast, but when dissected it was surprising to find that it was 'full of water'! Most of the muscles had dwindled to shadows and the alimentary canal was but a thin membrane filled with water too! In passing, the following examples of reptiles surviving without food may be of interest. A Checkered Water-Snake [*Natrix piscator* (Linn.)] which went on hunger strike and kept at it, survived ten months. An Earth Boa [*Eryx johnii* (Boie)] went one better than his aquatic brother. The Boa was a good healthy specimen which had been in captivity a few years—perhaps two or three. It was kept fasting for eighteen months, at the end of which it was somewhat emaciated, but as the test had lasted long enough the animal was given small mice and rats. Gradually it returned to normal and lived for another three years.

General.—Not far from my bungalow a well was being dug on a site formally occupied by a water-tap. The surroundings were slushy. About six inches below the surface a pickaxe pierced the carapace of a Pond Turtle which was aestivating there! This took place in the month of April.

The flesh of the Pond Turtle is eaten by the East Indians and Goans, and animals are often seen in the bazaars exposed for sale.

ORDER: SQUAMATA.

SUBORDER: SAURIA.

FAMILY. *Gekkonidae*: The Geckos.

This group of lizards is perhaps the most familiar of all in India, some of the species are found in almost every Indian household and there are numerous quaint superstitious beliefs attending to them. Geckoes are commonly referred to as Fly-catchers or House-lizards—general terms with neither generic nor specific value. House-lizards in different districts are not always the same, while many species found in houses are also found far from habitations on trees and rocks.

Poisonous Geckoes.—In India many geckoes are regarded as poisonous. Some are even said to be identical with the mythical *Bis-cobra.* Not only their bite, but mere contact with their excretions is believed to be attended with fatal results. The truth is that if geckoes were in any way poisonous this paper would not have been written. Nevertheless, like all superstitions the *Poisonous Gecko* will die hard. Owing to these beliefs, geckoes are often killed. On the contrary, they should be encouraged in the house, as without either injury to persons or property they feed on insects many of which are harmful.

Eggs.—Usually only two eggs are laid at a time. These are slightly agglutinated together and to the surface they are laid on. In shape they are generally spherical and are covered with a fragile, calcareous shell. The size varies greatly from species to species and there is also a slight difference between those laid by individuals of the same species. The presence of smaller eggs in the ovary together with the developed pair, suggests that perhaps more than one clutch is laid by the same individual at different intervals. This may explain the presence of half-developed eggs in *Hemidactylus brooki* obtained on the 19th May by which time the general breeding season is nearing its close (Salsette).

Egg-tooth.—The rupture of the egg in geckoes may sometimes be described as 'circumscissile' (i.e. splitting along the equatorial line), but this is not always true, the shell more often breaks up irregularly. Referring to this Dr. Malcolm Smith[1] writes:—

> 'For the rupture of the shell the embryo is provided with a sharp calcareous egg-tooth at the extreme tip of the mouth. This is shed shortly after birth. In the Geckoes the tooth is double, but in all lizards, so far as is known, it is single.'

Mr. Mahendra[2] observes that there is no egg-tooth in the case of *H. flaviviridis.* My observations agree with those of Dr. Smith, viz., the egg-tooth *is present and is double.* The egg-tooth in geckoes is composed of two pear-shaped bodies which only protrude *very* slightly from under the upper 'lip'. If casually looked for they are barely visible, but if the mouth of a newly hatched young is examined, the two bodies are clearly seen. A pocket lens is not always sufficient to verify this point definitely.

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[1] *F. B. Ind.* (Reptilia), vol. ii, p. 5, 2nd edn. (1935).

[2] *Proc. Ind. Ac. Sc.*, vol. iv (1936).

Territorial rights.—Territorial rights are preserved at all seasons, but when food is abundant, particularly in the neighbourhood of lights, several lizards may be seen feeding in close proximity. During the breeding season in some cases I have observed a certain grouping of individuals within definite limits. Intruders are vigorously chased out of the area. The same diurnal retreat is occupied day after day, and unless the animal is frequently disturbed it will not change its place.

Colour-markings. Colour in geckoes, as with many other lizards, I have found to be a very unreliable character, and accordingly, from a diagnostic point of view, has little, if any, importance. There may be 'definite' markings, often seen in preserved specimens, and certain colour characteristics in the young, but in life these markings may or may not be present. Perhaps an exception to this 'rule' is seen in *H. maculatus.* It has very characteristic markings, both in life and in the preserved state. Here again the markings tend to disappear when the animal becomes very dark in general tone; the blotches merge into the surrounding hue, but when the lighter tones are assumed the markings stand out very prominently. *H. maculatus* does not appear to be able to dim the series of blotches to any great extent. Whether by day or by night, I have always found that Hemidactyls simulate the colouring of the surface they are on at the time. Colour change is imperceptibly gradual.

Fragility of Tail. The fragility of the tail in geckoes is well known. In the first place, the tail is used (in some species) as a store for reserve food material. Well-fed lizards develop a thick basal portion which in some species becomes annulated, but generally, after the 'winter sleep' is very lean. In the second, it is used as an evasive device, when detached, forming a distraction to the enemy as it actively wriggles about for quite a long time after being severed, while the lizard itself makes its escape—a tail for a life! There is a limit to the point at which a tail may be detached. In males the last point of detachment is usually one segment below the termination of the pockets of the hemipenes, but in females it is a little higher up. Generally it is about 2-3 segments below its union with the body. The tail is soon rejuvenated and may become as long as the original, but the scaling and colouration is quite different from the original. Injury to the original may result in bifurcation at the point of injury, but at times two or even three new tails may be formed at the point of severance. By injection of a fluid into a fresh tail I was able to break it up at various points.

Eyes.—The dilation of the pupil appears to be controlled by the activity of the animal. Even in bright lamp-light the pupils remain wide open or but slightly closed, the eyes appearing quite black, instead of having the characteristic slit. A similar condition I have observed in the Chunam Frog (*Rhacophorus maculatus*).

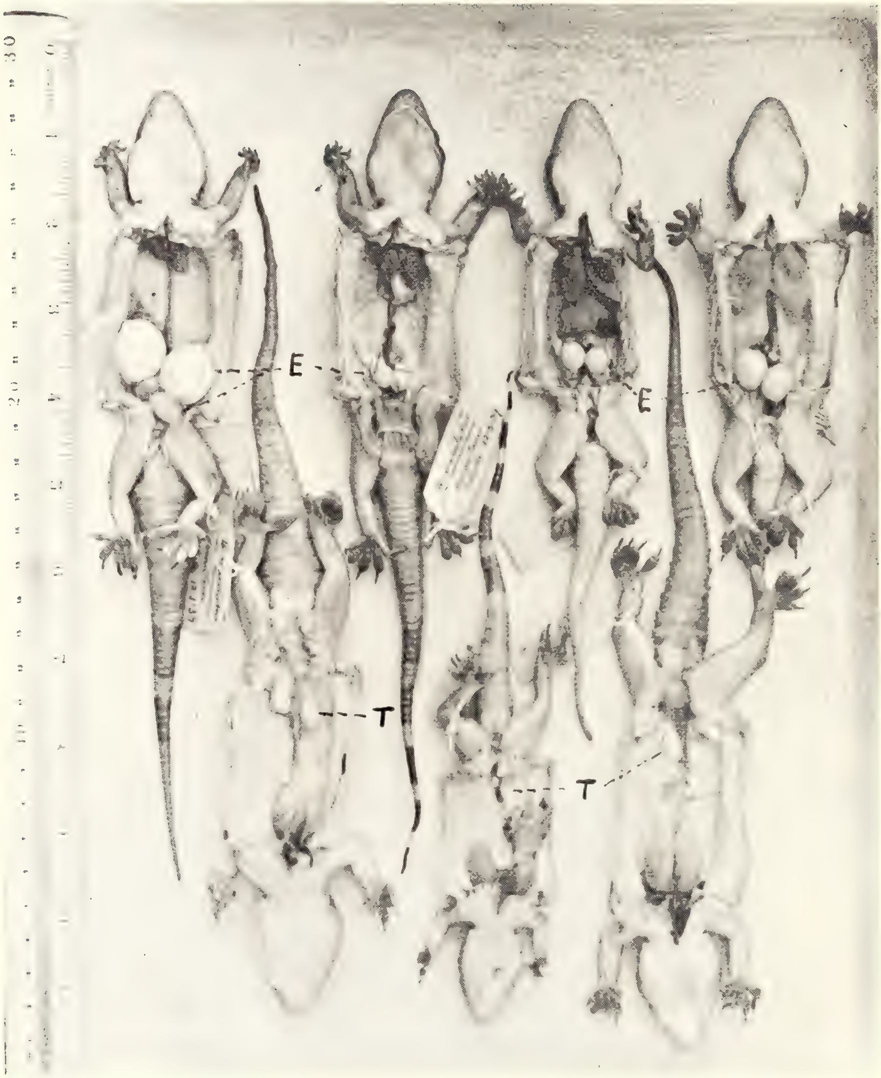

Photo: *C. McCann.*

The Rock Gecko (*Hemidactylus maculatus* Smith).
(Top row females; bottom row males).

Hemidactylus maculatus Smith. The Rock Gecko.

This gecko, one of the largest Indian Hemidactyls, shows a predilection for rough surfaces and is generally found in caves and rock crevices. It is common in the Kanari Caves, Salsette, but I have not observed it elsewhere in the island. At Panchgani (4,000 ft.), where the majority of the houses are built of blocks of laterite, this lizard is the common 'House Gecko', living chiefly on the unsurfaced exteriors of the buildings, but it also frequents the internal walls, particularly during the rains. During the day it retires into cracks or under the roofs.

At Panchgani, on two occasions only, I have found this lizard on trees; once an immature one, on the stem of a Silver Oak among Ivy quite close to a bungalow; and another on the 'fluted' stem of a *Ficus* near a street lamp. Perhaps the more abundant food, attracted by the light, occasioned the 'unusual' situation, though in the case of the former instance no light was near the tree.

Breeding season.—In Salsette, the general breeding season coincides with that of the other species present in the area, i.e. between February and April. The sexes appear to live together. In the Kanari caves, Mr. H. Ali and I collected them in March (1939), generally in couples; however, in one cave there were three females together and in another a single immature male. Immaturity appears to be outwardly indicated by the strong, very characteristic banding of the terminal third of the tail; but a rejuvenated tail does not show the markings. The young born in one year are just a little smaller than full adults at the next breeding season. Evidently they do not breed till the second season after birth.

During the Easter holidays of 1939 (9-13th April) I visited Panchgani with the express purpose of collecting further specimens in breeding condition. Having secured *H. maculatus* in full breeding condition in Salsette, I expected to find the Panchgani individuals in much the same condition, but dissection soon dispelled this notion. The Panchgani lizards were just at the beginning of their breeding season. The reproductive organs in both sexes were small when compared with those of the Salsette specimens. This variation in the time of the breeding season may perhaps be explained by, (*a*) the altitude and consequently cooler nocturnal temperature; (*b*) the food supply, a very serious factor on the dry hills of the Deccan. If young were hatched before the rains they would obtain but little food. Therefore I am of the opinion that the Panchgani individuals breed later in the year. On the whole the Panchgani specimens were much more emaciated in appearance than the Salsette ones. A further point of interest which is coincident with the later breeding season, is that, at Panchgani immature (half-grown) individuals were far more common than in Salsette, this possibly is a result of later breeding and scantier food supply.

Eggs.—A pair caught in the Kanari Caves, on the 12th March (1939) were kept in a box. On the 20th two eggs measuring 19×16 mm. were laid. They were slightly glued to the surface, and proved to be sterile.

Measurements of Hemidactylus maculatus in millimeters.

Species	Locality	Date	Sex	Pores	Size of Testes	No. of Eggs	Size of Eggs	Snout to vent	Vent to tip of tail	Remarks
Hemidactylus maculatus ...	Kanari Caves, Salsette Isl. ...	12–3–1939	♀	...	...	*2 + ?	†11	104	62 (R) ‡	
Do. ...	Do. ...	do.	♀	...	...	2 + 3	19 × 15	109	127	Smaller eggs 11 × 9. Larger eggs in oviduct.
Do. ...	Do. ...	do.	♀	...	...	2 + 1	7	108	124 (R)	
Do. ...	Do. ...	do.	♀	...	...	2 + 2	9	102	91 (R)	
Do. ...	Do. ...	do.	♀	...	...	...	...	116	124	Not dissected. Laid 2 eggs on 20-3-39
Do. ...	Do. ...	do.	♂	16 + 16	Imperfect	...	...	88	114	non-breeding male.
Do. ...	Do. ..	do.	♂	19 + 19	8 × 6	...	...	115	136	
Do. ...	Do. ...	do.	♂	19 + 17	10 × 6	...	...	121	124 (R)	
Do. ...	Do. ...	do.	♂	19 + 20	...	...	...	117	151	Not dissected.
Do. ...	Panchgani ...	Easter 1939	♂	19 + 19	5 × 2	...	...	108	71 (R)	
Do. ...	Do. ...	do.	♂	18 + 19	4 × 2	...	...	104	58 (R)	
Do. ...	Do. ...	do.	♂	19 + 19	4·5 × 2	...	...	111	104 (R)	
Do. ...	Do. ...	do.	♂	19 + 19	...	...	...	107·5	103 (R)	Not dissected.
Do. ...	Do. ...	do.	♂	18 + 19	...	...	...	74	97	Not dissected F. P. obscure.
Do. ...	Do. ...	do.	♀	...	...	...	...	70	92	Not dissected.
Do. ...	Do. ...	do.	♀	...	...	...	...	81	107	do.
Do. ...	Do. ...	do.	♀	...	...	...	...	80·5	99	do.
Do. ..	Do. ...	do.	♀	...	...	...	...	64	80	do.
Do. ...	Do. ...	do.	♀	...	...	...	...	76	79 (R)	do.
Do. ...	Do. ...	do.	♀	...	...	...	...	77	99	do.
Do. ...	Do. ...	do.	♀	...	...	...	...	101	91 (R)	do.
Do. ...	Do. ...	do.	♀	...	...	...	...	100	99 (R)	do.
Do. ...	Do. ...	do.	♀	...	...	0 + 8	3 mm.	111	117 (R)	do.
Do. ...	Do. ...	do.	♀	...	..	0 + 8	Small	97	87 (R)	

Do.	Do.	do.	♀	...	...	0 + 12	3	113	113 (R)	
Do.	Do.	do.	♀	...	...	0 + 7(?)	3	118	104 (R)	
Do.	Do.	do.	♀	...	...	0 + 8	3 mm.	112	74 (R)	
Do.	Do.	do.	♀	...	...	0 + 11	3	108	95 (R)	
Do.	Do.	do.	♀	...	...	...	...	106	91 (R)	
Do.	Do.	do.	♂	18 + 18	...	...	...	104	105 (R)	
Do.	Do.	do.	♀	...	...	...	...	102	117 (R)	
Do.	Do.	do.	♀	...	...	...	...	110	87 (R)	
Do.	Do.	do.	♀	...	...	...	...	108	102 (R)	
Do.	Do.	do.	♀	...	...	...	...	92	...	
Do.	Do.	do.	♀	...	...	...	...	91	111	
Do.	Kanari Caves, Salsette Isl.	8-6-1939	♀	...	...	6	Small	115	114 (R)	Genitals undergoing reduction (resorption).
Do.	Do.	do.	♂	17 + 16	...	...	...	104	112 (R)	Not dissected.
Do.	Do.	do.	♂	19 + 18	Small	...	...	106	88 (R)	Genitals reduced.
Do.	Do.	do.	♂	17 + 17	Do.	...	...	92	106	Juv. genital very reduced.

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* The first figure indicates the number of maturing eggs, the second the smaller eggs.
† A single figure indicates the eggs are spherical and still in the body cavity.
‡ R = rejuvenated.

Measurements of Hemidactylus maculatus in millimeters.

Species	Locality	Date	Sex	Pores	Size of Testes	No. of Eggs	Size of Eggs	Snout to vent	Vent to tip of tail	Remarks
Hemidactylus maculatus	Kanari Caves, Salsette Isl.	12-3-1939	♀	...	...	*2 + ?	†11	104	62 (R) ‡	
Do.	Do.	do.	♀	...	...	2 + 3	19 × 15	109	127	Smaller eggs 11 × 9. Larger eggs in oviduct.
Do.	Do.	do.	♀	...	...	2 + 1	7	108	124 (R)	
Do.	Do.	do.	♀	...	...	2 + 2	9	102	91 (R)	
Do.	Do.	do.	♀	...	...	...	...	116	124	Not dissected. Laid 2 eggs on 20-3-39
Do.	Do.	do.	♂	16 + 16	Imperfect	...	...	88	114	non-breeding male.
Do.	Do.	do.	♂	19 + 19	8 × 6	...	...	115	136	
Do.	Do.	do.	♂	19 + 17	10 × 6	...	...	121	124 (R)	
Do.	Do.	do.	♂	19 + 20	...	...	...	117	151	Not dissected.
Do.	Panchgani	Easter 1939	♂	19 + 19	5 × 2	...	...	108	71 (R)	
Do.	Do.	do.	♂	18 + 19	4 × 2	...	...	104	58 (R)	
Do.	Do.	do.	♂	19 + 19	4·5 × 2	...	...	111	104 (R)	
Do.	Do.	do.	♂	19 + 19	...	...	...	107·5	103 (R)	Not dissected.
Do.	Do.	do.	♂	18 + 19	..	...	...	74	97	Not dissected F. P. obscure.
Do.	Do.	do.	♀	...	...	...	...	70	92	Not dissected.
Do.	Do.	do.	♀	...	...	...	...	81	107	do.
Do.	Do.	do.	♀	...	...	...	...	80·5	99	do.
Do.	Do.	do.	♀	...	...	...	...	64	80	do.
Do.	Do.	do.	♀	...	...	...	...	76	79 (R)	do.
Do.	Do.	do.	♀	...	...	...	...	77	99	do.
Do.	Do.	do.	♀	...	...	...	...	101	91 (R)	do.
Do.	Do.	do.	♀	...	...	...	...	100	99 (R)	do.
Do.	Do.	do.	♀	...	...	0 + 8	3 mm.	111	117 (R)	do.
Do.	Do.	do.	♀	...	..	0 + 8	Small	97	87 (R)	
Do.	Do.	do.	♀	...	...	0 + 12	3	113	113 (R)	
Do.	Do.	do.	♀	...	...	0 + 7(?)	3	118	104 (R)	
Do.	Do.	do.	♀	...	...	0 + 8	3 mm.	112	74 (R)	
Do.	Do.	do.	♀	...	...	0 + 11	3	108	95 (R)	
Do.	Do.	do.	♀	...	...	...	...	106	91 (R)	
Do.	Do.	do.	♂	18 + 18	...	...	...	104	105 (R)	
Do.	Do.	do.	♀	...	...	...	...	102	117 (R)	
Do.	Do.	do.	♀	...	...	...	...	110	87 (R)	
Do.	Do.	do.	♀	...	...	...	...	108	102 (R)	
Do.	Do.	do.	♀	...	...	...	...	92	...	
Do.	Do.	do.	♀	...	...	...	...	91	111	
Do.	Kanari Caves, Salsette Isl.	8-6-1939	♀	...	...	6	Small	115	114 (R)	Genitals undergoing reduction (resorption).
Do.	Do.	do.	♂	17 + 16	...	...	...	104	112 (R)	Not dissected.
Do.	Do.	do.	♂	19 + 18	Small	...	...	106	88 (R)	Genitals reduced.
Do.	Do.	do.	♂	17 + 17	Do.	...	...	92	106	Juv. genital very reduced.

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* The first figure indicates the number of maturing eggs, the second the smaller eggs.

† A single figure indicates the eggs are spherical and still in the body cavity.

‡ R = rejuvenated.

Measurements of Hemidactylus spp. in millimeters.

Species	Locality	Date	Sex	No. of Pores	Size of Testes	No. of Eggs	Size of Eggs	Head & Body	Tail	Remarks
Hemidactylus brooki ...	Andheri, Salsette Isl. ...	6–2–39	♀	...	...	2 + 3	8·5 × 6·5	58	58·5 (R)	
Do. ...	Do. ...	5–2–39	♀	...	...	2 + 3	10 × 6	55	55 (R)	
Do. ...	Do. ...	17–2–39	♀	...	...	?	Small	53	46 (R)	
Do. ...	Do. ...	5–2–39	♀	...	...	2 + 2	9·5 × 8	50	50 (R)	
Do. ...	Do. ...	6–2–39	♀	...	...	2 + 3	10 × 7	48·5	50 (R)	
Do. ...	Do. ...	5–2–39	♀	...	...	2 + 3	9 × 6	51	54 (R)	
Do. ...	Do. ...	6–2–39	♀	...	...	2 + 7	9·5 × 7	50	54 (R)	
Do. ...	Do. ...	29–1–39	♀	...	...	1 + 5	10 × 8	55·5	lost	
Do. ...	Do. ...	6–2–39	♀	...	...	2 + 2	10 × 7·5	52	44·5 (R)	
Do. ...	Do. ...	19–5–38	♀	...	...	2 + 2 (?)	6	51	lost	
Do. ...	Do. ...	6–2–39	♀	...	...	2 + 6	4	51	58 (R)	
Do. ...	Do. ...	5–2–39	♀	...	...	2 + 4	less than 4	55	53 (R)	
Do. ...	Do. ...	6–2–39	♀	...	...	2 + 4	...	45	45 (R)	
Do. ...	Do. ...	6–2–39	♂	7 + 6	7 × 4	...	...	48	53 (R)	
Do. ...	Do. ...	5–2–39	♂	7 + 5	7·5 × 4·5	...	...	54·5	41 (R)	
Do. ...	Do. ...	17–2–39	♂	13 + 13	9 × 4	...	...	55	50 (R)	
Do. ...	Do. ...	6–2–39	♂	7 + 8	7 × 4·5	...	...	54	59	
Do. ...	Do. ...	16–4–39	♂	7 + 8	5 × 2	...	...	57	59	Testes spent.
Do. ...	Do. ...	16–4–39	♀	...	...	0 + 5	Small	54	39 (R)	Caught in March; laid 2 eggs on 3 April.
Do. ...	Do. ...	5–2–39	♂	6 + 6	8 × 4	...	...	58	56 (R)	
Do. ...	Do. ...	9–3–39	♀	...	...	2 + 4	6	55	?	
Do. ...	Panchgani ...	Easter 1939	♀	...	...	2 + ?	Large	53	Broken	Not dissected. Eggs large and clearly visible.
Hemidactylus frenatus ...	Andheri, Salsette Isl. ...	5–2–39	♂	14 + 15	6 × 3·5	...	...	52·5	40 (R)	
Do. ...	Do. ...	17–2–39	♂	15 + 14	6 × 2·5	...	...	46	52	
Do. ...	Do. ...	31–3–39	♀	...	...	...	...	41·5	20·5 (R)	Laid 2 eggs on 3 April; bottled 16–4–39. Eggs hatched on 15th and 16th May.

Measurements of Hemidactylus spp. in millimeters.

Species	Locality	Date	Sex	No. of Pores	Size of Testes	No. of Eggs	Size of Eggs	Head & Body	Tail	Remarks
Hemidactylus frenatus	Andheri, Salsette Isl.	...	?	...	...	...	...	17·5	14	Egg laid 3 April; hatched out on 16-5-39.
Hemidactylus flaviviridis	Andheri, Salsette Isl.	5-2-1939	♀	...	...	2 + 6	4	77·5	85	
Do.	Do.	Do.	♀	...	...	2 + 4	4	75	52 (R)	
Do.	Do.	17-2-1939	♀	...	...	2 + ?	9	79	65 (R)	
Do.	Do.	13-5-1938	♀	...	...	None	...	85	96·5	
Do.	Do.	17-2-1939	♀	...	...	2 + 4	9	83	105	
Do.	Do.	14-5-1938	♀	...	...	None	...	81	77 (R)	Tail bifid.
Do.	Do.	6-2-1939	♀	...	...	2 + 7	7	84	79·5	Tail trifid, 3 eggs maturing together.
Do.	Do.	20-5-1938	♂	7 + 6	Not developed	...	...	89	71·5 (R)	
Do.	Do.	5-2-1939	♂	7 + 7	7 × 4·5	...	...	65	61 (R)	
Do.	Do.	15-4-1939	♀ (?)	...	...	...	...	30·5	32	A recent hatchling.
Do.	Do.	9-3-1939	♂	6 + 6	6 × 4	...	...	54	70·5	
Do.	Do.	Do.	♂	6 + 6	9 × 4·5	...	...	88	58 (R)	
Do.	Do.	16-4-1939	♂	7 + 6	5 × 2	...	...	61	97	Testes exhausted.
Do.	Do.	Do.	♀	...	...	2 + 4	11 × 8	74	93	
Do.	Do.	Do.	♀	...	...	0 + 7	Small	75	39 (R)	
Do.	Do.	Do.	♀	...	...	0 + 5	Do.	76	52 (R)	
Do.	Do.	17-4-1939	(?)	...	...	...	...	30	31	
Do.	Do.	28-4-1939	(?)	...	...	...	...	31	35	
Do.	Do.	...	(?)	...	...	...	...	29	32	Egg laid 1-4-1939; hatched 24-5-1939. Bottled immediately on hatching.

Measurements of Hemidactylus spp. in millimeters.

Species	Locality	Date	Sex	No. of Pores	Size of Testes	No. of Eggs	Size of Eggs	Head & Body	Tail	Remarks
Hemidactylus brooki ...	Andheri, Salsette Isl. ...	6–2–39	♀	...	...	2+3	8·5×6·5	58	58·5 (R)	
Do. ...	Do. ...	5–2–39	♀	...	...	2+3	10×6	55	55 (R)	
Do. ...	Do. ...	17–2–39	♀	...	...	?	Small	53	46 (R)	
Do. ...	Do. ...	5–2–39	♀	...	...	2+2	9·5×8	50	50 (R)	
Do. ...	Do. ...	6–2–39	♀	...	...	2+3	10×7	48·5	50 (R)	
Do. ...	Do. ...	5–2–39	♀	...	...	2+3	9×6	51	54 (R)	
Do. ...	Do. ...	6–2–39	♀	...	...	2+7	9·5×7	50	54 (R)	
Do. ...	Do. ...	29–1–39	♀	...	...	1+5	10×8	55·5	lost	
Do. ...	Do. ...	6–2–39	♀	...	...	2+2	10×7·5	52	44·5 (R)	
Do. ...	Do. ...	19–5–38	♀	...	...	2+2 (?)	6	51	lost	
Do. ...	Do. ...	6–2–39	♀	...	...	2+6	4	51	58 (R)	
Do. ...	Do. ...	5–2–39	♀	...	...	2+4	less than 4	55	53 (R)	
Do. ...	Do. ...	6–2–39	♀	...	...	2+4	...	45	45 (R)	
Do. ...	Do. ...	6–2–39	♂	7+6	7×4	...	...	48	53 (R)	
Do. ...	Do. ...	5–2–39	♂	7+5	7·5×4·5	...	...	54·5	41 (R)	
Do. ...	Do. ...	17–2–39	♂	13+13	9×4	...	...	55	50 (R)	
Do. ...	Do. ...	6–2–39	♂	7+8	7×4·5	...	...	54	59	
Do. ...	Do. ...	16–4–39	♂	7+8	5×2	...	...	57	59	Testes spent.
Do. ...	Do. ...	16–4–39	♀	...	...	0+5	Small	54	39 (R)	Caught in March; laid 2 eggs on 3 April.
Do. ...	Do. ...	5–2–39	♂	6+6	8×4	...	...	58	56 (R)	
Do. ...	Do. ...	9–3–39	♀	...	...	2+4	6	55	?	
Do. ...	Panchgani ...	Easter 1939	♀	...	...	2+?	Large	53	Broken	Not dissected. Eggs large and clearly visible.
Hemidactylus frenatus ...	Andheri, Salsette Isl. ...	5–2–39	♂	14+15	6×3·5	...	...	52·5	40 (R)	
Do. ...	Do. ...	17–2–39	♂	15+14	6×2·5	...	...	46	52	
Do. ...	Do. ...	31–3–39	♀	...	...	...	...	41·5	20·5 (R)	Laid 2 eggs on 3 April; bottled 16–4–39. Eggs hatched on 15th and 16th May.

Measurements of Hemidactylus spp. in millimeters.

Species	Locality	Date	Sex	No. of Pores	Size of Testes	No. of Eggs	Size of Eggs	Head & Body	Tail	Remarks
Hemidactylus frenatus ...	Andheri, Salsette Isl. ...	...	?	...	...	...	...	17·5	14	Egg laid 3 April; hatched out on 16–5–39.
Hemidactylus flaviviridis ...	Andheri, Salsette Isl. ...	5–2–1939	♀	...	...	2+6	4	77·5	85	
Do. ...	Do. ...	Do.	♀	...	...	2+4	4	75	52 (R)	
Do. ...	Do. ...	17–2–1939	♀	...	...	2+?	9	79	65 (R)	
Do. ...	Do. ...	13–5–1938	♀	...	...	None	...	85	96·5	
Do. ...	Do. ...	17–2–1939	♀	...	...	2+4	9	83	105	
Do. ...	Do. ...	14–5–1938	♀	...	...	None	...	81	77 (R)	Tail bifid.
Do. ...	Do. ...	6–2–1939	♀	...	...	2+7	7	84	79·5	Tail trifid, 3 eggs maturing together.
Do. ...	Do. ...	20–5–1938	♂	7+6	Not developed	...	...	89	71·5 (R)	
Do. ...	Do. ...	5–2–1939	♂	7+7	7×4·5	...	...	65	61 (R)	
Do. ...	Do. ...	15–4–1939	♀ (?)	...	...	...	...	30·5	32	A recent hatchling.
Do. ...	Do. ...	9–3–1939	♂	6+6	6×4	...	...	54	70·5	
Do. ...	Do. ...	Do.	♂	6+6	9×4·5	...	...	88	58 (R)	
Do. ...	Do. ...	16–4–1939	♂	7+6	5×2	...	...	61	97	Testes exhausted.
Do. ...	Do. ...	Do.	♀	...	...	2+4	11×8	74	93	
Do. ...	Do. ...	Do.	♀	...	...	0+7	Small	75	39 (R)	
Do. ...	Do. ...	Do.	♀	...	...	0+5	Do.	76	52 (R)	
Do. ...	Do. ...	17–4–1939	(?)	...	...	...	...	30	31	
Do. ...	Do. ...	28–4–1939	(?)	...	...	...	...	31	35	
Do. ...	Do. ...	...	(?)	...	...	...	...	29	32	Egg laid 1–4–1939; hatched 24–5–1939. Bottled immediately on hatching.

Size.—The *Fauna* (Vol. ii; p. 86), gives the maximum length of this species as, 'snout to vent 115; tail 130 mm.' It will be seen from the table of measurements that both these sizes have been exceeded. The old males are usually larger than the females.

Voice.—The only sound I have heard this lizard produce is a drawn out noise, which can be likened only to the 'straining of a rope.'

Food.—The food consists chiefly of insects; but one specimen contained a full-sized *H. brooki*—the stomach was so distended that it extended from the neighbourhood of the heart to the lower part of the rectum.

Hemidactylus brooki Gray. Brooks' Gecko.

According to the *Fauna*, p. 91, *H. brooki* is supposed to be the *commonest* house-gecko in India. It certainly may have the widest distribution, but it is certainly not the commonest 'House-Gecko' in all parts of the country. In Salsette, for instance, *H. brooki* is very common and lives mainly in the forests, on trees, rocks and under stones. In the vicinity of human habitations, on compound walls, on the external walls of houses and in houses not already tenanted by *H. flaviviridis*. The latter usually hunts out the former.

Breeding Season.—In Salsette, the breeding season generally sets in with the commencement of the warm weather, about the end of February. On the 19th May (1938) I captured a gravid female at Andheri, with two half-developed eggs measuring 5·5 mm. This specimen measured: snout to vent 51 mm.; vent to tip of tail 60 mm. Another gravid specimen was caught on the 29th January (1939), containing a single egg, 9 mm., in the right oviduct and five smaller eggs in the body cavity. It measured, snout to vent 55 mm.; tail lost. (For further details see table).

In Panchgani, during the Easter holidays of 1939 (April 9-13th), I often found this gecko on the outside walls of buildings in company with (but never near) *H. maculatus*. At the time *H. brooki* was in full breeding.

Mr. Mahendra[1] referring to this species observes that at Agra it lays in July and August and not throughout the year. This later breeding at Agra is probably in keeping with the climatic conditions and the food supply.

Eggs.—From a comparison of the eggs (see table) it appears that the eggs in this species remain in the body cavity till they are 6 mm. in diameter and then enter the oviduct. While in the body cavity the eggs are spherical, but become longer than broad on entering the oviducts. On being laid they once more assume the spheroidal shape.

Voice.—*H. brooki* is perhaps the most vociferous of the commoner geckoes, but more so at the breeding season. It indulges in a loud, sharp, '*chuck-chuck*' repeated several times, like 'audible kisses.'

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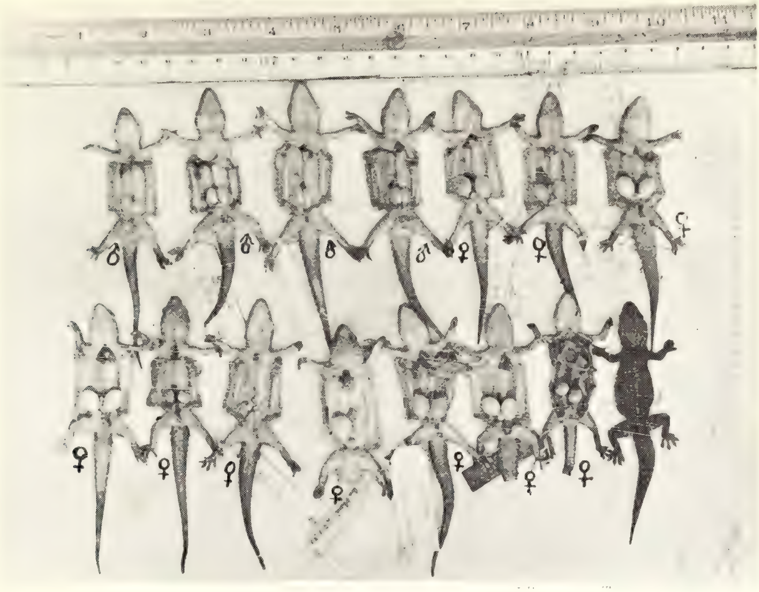
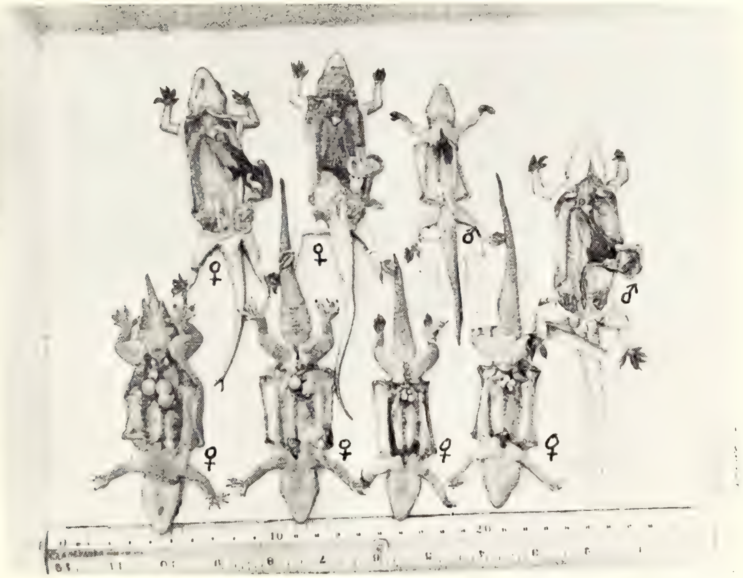
[1] *Proc. Ind. Ac. Sc.*, vol. iv (1936) p. 277.



Brook's Gecko (*Hemidactylus brooki* Gray).



Photos: *C. McCann.*

The Common House-Gecko (*Hemidactylus flaviviridis* Rüppel.)
Note the female with the trifid tail and three maturing eggs.

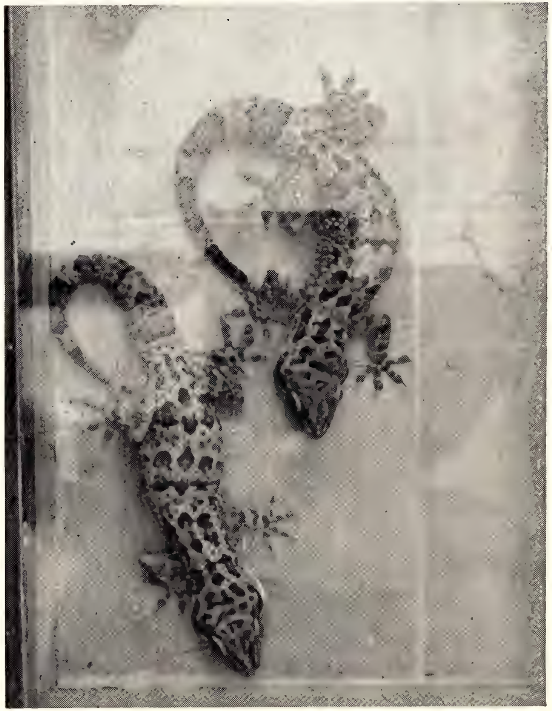


Photo : *C. McCann.*
Male and female Rock Gecko.
(*Hemidactylus maculatus* Smith).

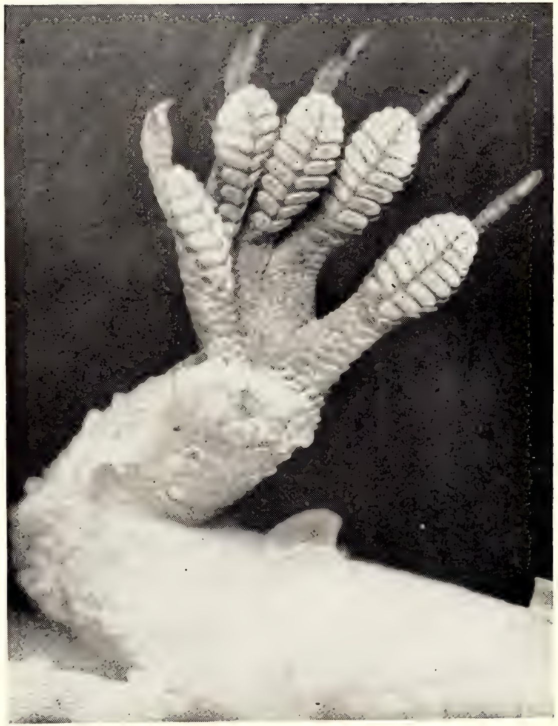


Photo : *A. R. Hughes.*
Hind foot of Prashad's Gecko.
(*Hemidactylus prashadi* Smith).

Food.—The animal is mainly insectivorous. When not on or in houses, Brook's gecko feeds largely near or on the ground, on grasshoppers. I have often taken specimens with a single grasshopper completely filling and distending the stomach.

Hemidactylus prashadi Smith. Prashad's Gecko.

This species was first described by Dr. Malcolm Smith in the *Fauna* in honour of Dr. Baini Prashad of the Indian Museum. The first specimens were obtained by Drs. Prashad and Rao at Jog, N. Kanara. While on a visit to the Gersoppa Falls (Jog) in company with Mr. A. R. Hughes, at the break of the rains 1938 we caught nine specimens of this species living in the bungalow at the head of the Falls (British side). Others were taken on neighbouring trees.

Markings.—The 'cross-bars or series of spots' noted in the *Fauna* are not always seen in living specimens. Examples caught in the Bungalow, on the colour washed walls, certainly showed these marking very clearly; but those caught on trees showed no trace of them, they were mottled like the bark. Specimens preserved in alcohol do not all show the body marking, but on the tail the banding is distinctly visible. In the young the ground colour is usually darker than in adults, but the white banding of the body and tail stand out prominently. Most of the young were about one-third to half-grown (June).

Measurement.—Below I give a few measurements from the material collected:—The largest male from snout to vent 98 mm.; vent to tip of tail 136 mm.: preano-femoral pores 32 (16+16). The largest female, snout to vent 87.5 mm., vent to tip of tail 131.5 mm. The males appear to be generally larger. In females the preanal scales are somewhat conical while in males the same region is covered with imbricate scales.

Hemidactylus frenatus Schlegel. The Bridled Gecko.

On the 5th June 1938 three specimens of *H. frenatus* were caught in the District Bungalow at Sutgutti, near Belgaum. This was the only 'House-Gecko' observed in the locality.

Colour.—At Sutgutti it was found both on the interior and exterior walls of the bungalow and on the trellis of the verandah. On the white-washed walls at night the lizards were flesh-pink throughout, with no markings whatsoever (observed with an electric torch), but on the blackened trellis they were dark greyish-brown with broken longitudinal lines of a darker hue.

Two males seen on a tree in Salsette were greyish-brown, with longitudinal lines faintly visible. I have since seen further examples of this lizard in Salsette and the longitudinal stripes have always been present when on dark surfaces.

Breeding.—At Andheri two males were caught on roadside trees; and a single female which entered the house on the 1st April (1939). She was gravid, a point easily observed in geckoes through the thin abdominal skin. On the 3rd April she laid two eggs, measuring 8×6·5 mm. The young hatched out on the 15th and

16th May, 42 and 43 days respectively after the eggs were laid. One escaped from the glass container. They were at perfect ease on the glass surface and showed no difficulty in climbing. The eggs were firmly agglutinated to each other and to the glass surface. The two males referred to above were in full breeding condition, the testes being fully developed (see table).

Egg-tooth.—The egg-tooth is definitely present in this species. It forms two parallel pear-shaped bodies just under the median line of the upper 'lip' and only protrudes *very* slightly, making it difficult to observe, just as in *H. flaviviridis.*

Voice.—At Sutgutti in June the lizards were very vociferous and frequently called at intervals all night. The call is similar to that of *H. brooki.*

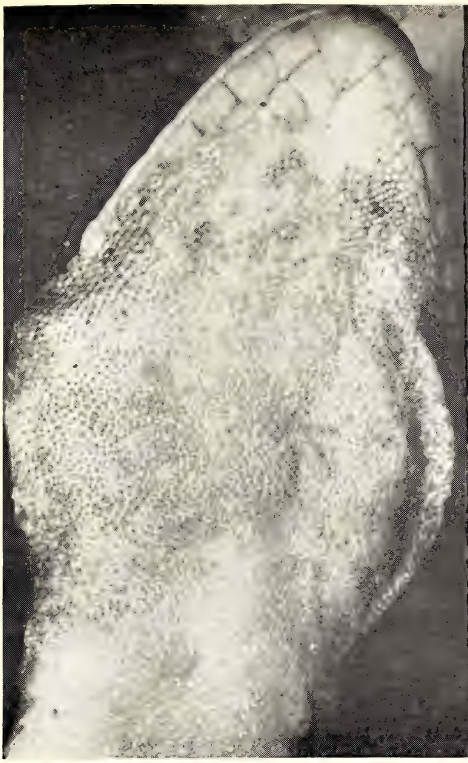
Distribution.—The *Fauna* p. 96 records, 'Southern India, Ceylon, Bengal;' as far as India is concerned. Outside India it is widely distributed. The occurrence of this species as far north as Bombay shows an extension of its range on the west.

Hemidactylus flaviviridis Rüppel. The Common House-Gecko.

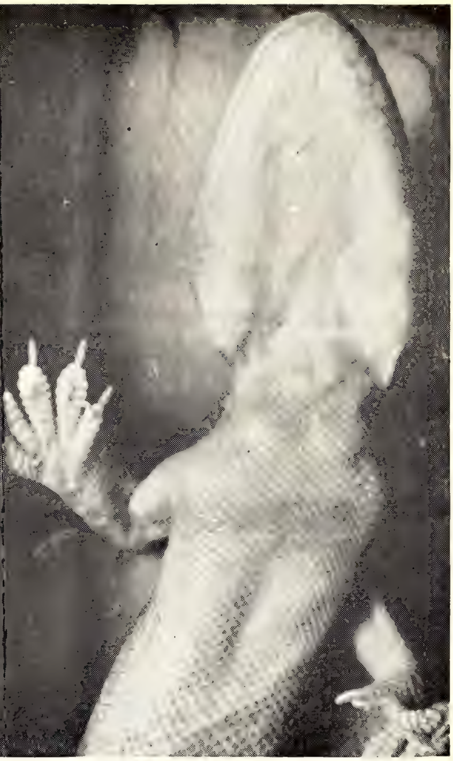
The *Fauna* describes this species as the northern form of *H. leschenaulti,* from which it is certainly difficult to separate, as certain characters overlap. If any reliance can be placed on the number of the femoral pores of which *H. flaviviridis* has the fewer (5-7 on each side) there should not be much difficulty in separating the males, but as this is purely a masculine character, what are we to do with the females?

H. flaviviridis is the common house-gecko in Bombay and Salsette. In this area it frequents more often the inside walls of buildings than the outer, where its place is often taken by *H. brooki.* It monopolizes the inside walls, driving out the smaller species, but it is also found on outside walls and trees not far from human habitation. In some respects it may be said to be commensal with man, and in houses where it is not molested it is almost 'tame', not minding the inmates. As I have not observed this species at Panchgani, 4,000 ft. I wonder whether its absence is due to altitude.

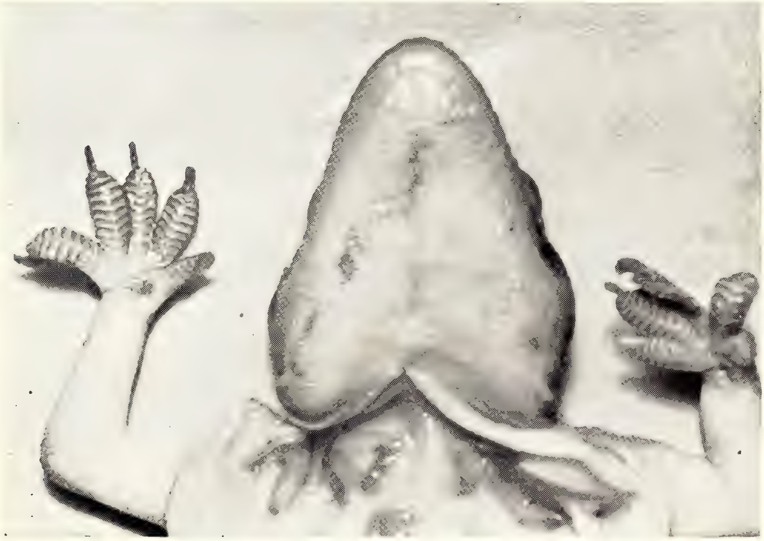
In Bombay and Salsette they are in evidence throughout the year, and their activity is dependent on weather conditions. In the cold season they are less active and generally secrete themselves, but as the weather becomes warmer, about the middle of February, the males begin to call. The call at this season is a low one which can only be imitated by the finger nail being jerkily drawn over a half-empty match box. It appears to be partly a challenge to other males and partly an invitation to the opposite sex. Fights between rival males are frequent at this period—it is the approach of the breeding season. Two males will challenge from a distance, then draw nearer and manœuvre round in semicircles, at the same time swaying their tails with slow undulating movements. They then stop, take stock of each other for a while, and suddenly one rushes at the other. If the opponent is strong enough it faces its antagonist and a fight ensues, but if weaker, it makes off and is pursued out of the victor's territory. In fights they bite each other fiercely,



Common House Gecko
(*Hemidactylus flaviviridis* Rüppel).



Prashad's Gecko
(*Hemidactylus prashadi* Smith).



Brook's Gecko (*Hemidactylus brooki* Gray).

Photos: *A. R. Hughes.*

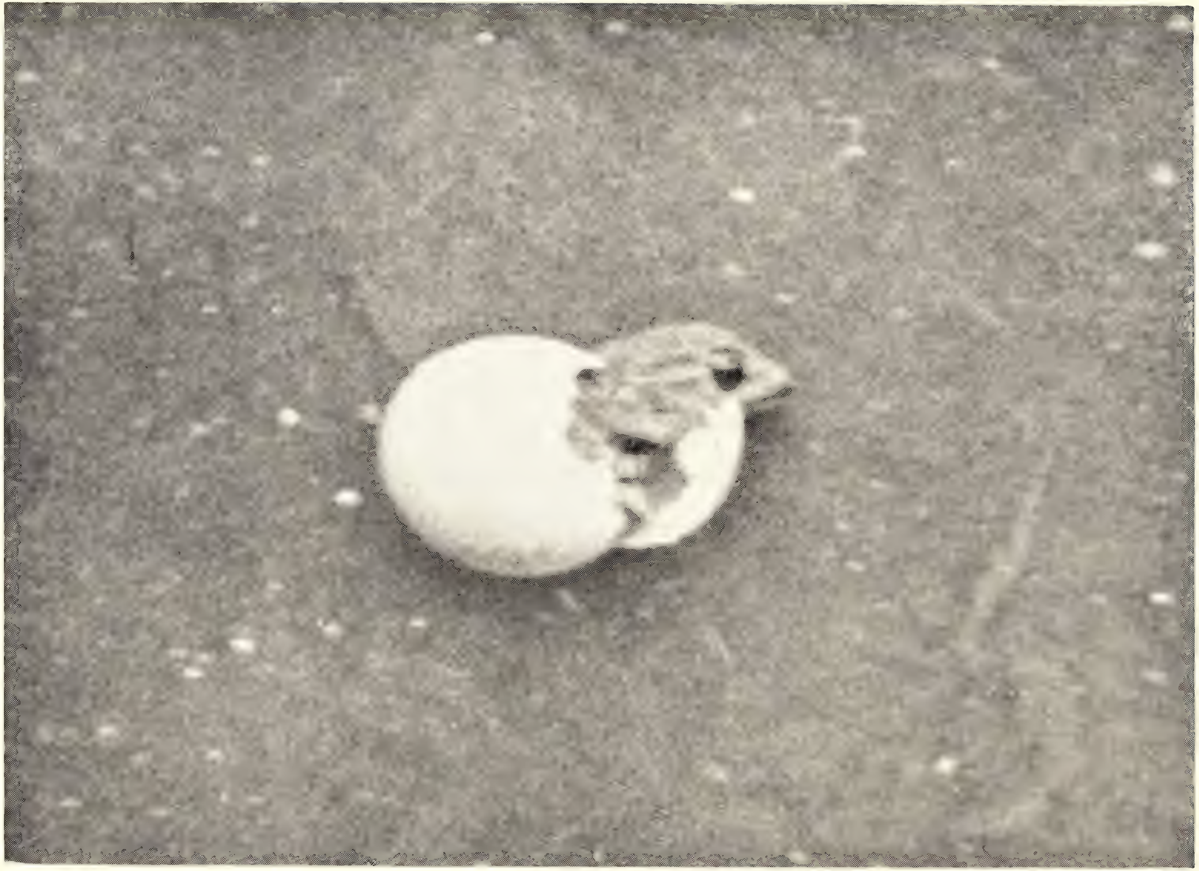


Photo: C. McCann.

The Common House-Gecko (*Hemidactylus flaviviridis* Rüppel) emerging from its egg. Egg laid on April 1st 1939; hatched on 24th May.

often bruising the delicate skin and in their ardour fall to the ground in the struggle. Here the contest may continue, but usually both take to flight. Ugly wounds are rare, but the tail is sometimes lost.

Territorial rigths.—Territorial rights are zealously preserved, but there appears to be a certain grouping during the breeding season, when two or more lizards occupy the same area—possibly a single male and the rest females; certain 'intruders' are chased out of the area. The predominance of females suggests that these lizards are polygamous. The *diurnal retreats are regularly* occupied—a more or less secluded spot away from bright light. Behind pictures and furniture are their favourite retreats. Behind pictures they are often crushed when a spring cleaning is in progress, but if they escape that fate, they invariably fall on the good housewife, much to her discomfort and perhaps to her detriment if standing on a chair ! Screams soon summon the whole household to the 'disaster' and the 'offender' is hunted and if found is mercilessly dispatched !

Though generally nocturnal, to see these lizards hawking insects by day is not uncommon. Once I saw one catching insects on a culvert in bright sunlight at 2 p.m., when the stones were hot !

In Salsette I have observed *H. flaviviridis* is more dependent on human habitations than any of the other species in the area, for though I have taken it on trees, the trees were never far from habitations. Once it establishes itself in a house, it does so, almost to the exclusion of the other smaller species. Sitting out in the garden of an evening I have frequently seen this lizard, at dusk, leave the house and go to the neighbouring trees or to the compound wall.

Courtship and breeding.—The courtship, at first, appears somewhat like the commencement of a contest between rivals. The male watches the female for a time, then slowly, but steadily, approaches, manoeuvring round, wagging his tail and uttering the 'scratching' sound as he approaches. He then stops, and both 'signal' by tail waggings to each other. The male approaches again, then suddenly the female makes off pursued by her suitor. As they run he catches up with her and takes hold of either the leg or the tail. As soon as she is seized she submits with a gentle trembling, uttering a faint cry the while. He releases her, and away she goes, but without loss of her tail which one might expect under the circumstances. This peculiar behaviour is repeated frequently and is just a prelude to the final act. Before copulation the male holds the female behind the neck with its jaws but releases this hold before completion of the act. In the first grip, the skin of the neck is often ruptured. On the 13th March 1940 I witnessed the prelude to and copulation itself in a pair of *H. flaviviridis;* the following observations were made:—The male rushed at the female, caught it by the right hind leg, the female did not resist The male gradually transferred its grip from the hind leg to the skin of the abdomen, and finally to the back of the neck, calling from time to time as it did so. The body of the two lizards were now almost in the same line. Gradually the female moved the lower part of her body over the back of the male, lifting her tail occasionally as she did so. In the struggle she would now and again loose her position. The male endeavoured to keep her in position with his left foreleg. Eventually the male twisted the hind end of his body in such a manner as to bring his cloaca in contact with that of the female. Copulation followed, the male releasing his hold of the female's neck at the same time. The whole process lasted about ten minutes. During the breeding season, several lizards may be seen bearing the marks of combat or of copulation. Another curious habit observed was that one lizard would approach another then put out its tongue once or twice, and as it were, lick the other's snout. This done the two would separate without any further attention.

In Bombay and Salsette mating usually takes place after the middle of February, when the weather warms up. The mating period appears to last for a month or two. In 1939 owing to the warm conditions during the latter part of December (1938) and during January (1939), the lizards were out earlier than usual. I have no definite information on the period of gestation but Prashad[1] tells us: 'The lizards laid two oval eggs on the 8th March just about two months after copulation'. If we are to accept this statement, viz., 'just two months after copulation', then copulation took place on the 8th January—the winter period in the Punjab. This is, however, not in keeping with his previous statement: 'The pairing season, it appears, is the beginning of the hot weather, just after the long hibernation period', nor with the statement 'with the approach of the winter the lizards retire . . .; coming out of their retreats about the beginning of March. Throughout the winter one never sees any of these lizards.'

Eggs.—The eggs are generally laid in couples, occasionally only one or three. They are slightly agglutinated together and to the surface they are laid on—just enough to keep them together. Mahendra (*l.c.* p. 270) states: 'I have not observed the presence of any such adhesive substance in the eggs of *H. flaviviridis*, even when new laid, nor have I so found the eggs stuck to each other, or to a substratum.' Though I have never attempted to systematically rear or breed these lizards, I have often found their eggs, and kept gravid females which laid in captivity. Some of the situations in which I have found the eggs, have been vertical walls, on the backs of cupboards and other furniture, on ledges, on curtains, and in table drawers, and in crevices of walls. If an adhesive were absent it would be difficult to explain their presence on a vertical surface! The eggs are generally laid away from strong light, and what is more, the adhering surface of at least one egg is slightly flattened. These points I have also observed in *H. maculatus, H. brooki* and *H. frenatus*. Old eggs generally drop off at the slightest touch.

Another point which Mr. Mahendra doubts is that geckoes do sometimes lay 'collectively', i.e. in the same crevice or other suitable spot. On a few occasions it has been my experience that geckoes

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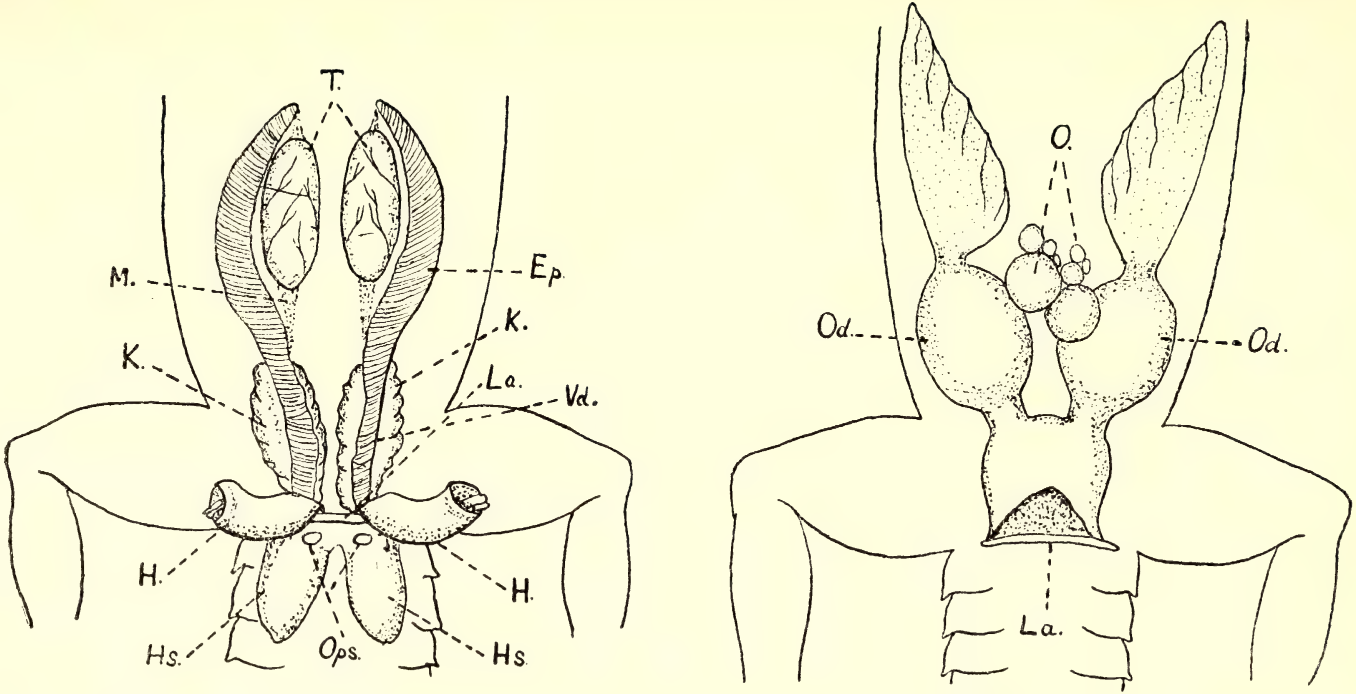
[1] *Journ. B.N.H.S.* xxiv, 838.



del, C. McCann.

Fig. A.

Fig. B.

Fig. A. and B. Male and female genital organs of ***Hemidactylus flaviviridis*** Rüppel (Diagrammatic)
Ep. epididymis; H. hemipenis; Hs. sac of hemipenis; K. kidney; La. lower lip of cloacum; M. mesoarium; O. ovaries; Od. oviduct; Ops. opening of postanal sac; T. testes.

do lay collectively, provided the locality is really a suitable one. In one of the Museum buildings there was a crevice under a cornice which was literally filled with eggs and egg-shells, most of which were stuck to the stone surface. Again in a disused table drawer in Mr. J. Jacobs's bungalow (P. W. Museum) there were three pairs of old eggs, besides shell remains of others. At the Kanari Caves, Salsette, I have found the eggs of *H. maculatus* similarly deposited together.

Eggs of different individuals vary slightly in size, but eggs laid by the same lizard are generally equal in proportions. Eggs measured by me varied between 9 and 14 mm. A pair of eggs laid on the 1st April (1939) measured 14×11 mm. One of these hatched out on the 24th May—in this case an incubation period of 54 days—the other I had opened before its time and found in it a well-developed embryo. Prashad (*l.c.*) referring to the eggs laid on 8th March writes:—Out of the eggs the young hatched out on the 13th June, about 37 days after the eggs had been laid . . .' There is evidently something wrong—8th March to 13th June is 95 days! 'March' should probably read May'. Mr. Mahendra records 34 and 33 days as the incubation period. There is a slight difference between the incubation periods recorded by Prashad and Mahendra but a considerable difference between their observations and my own. The reason for this variation is difficult to surmise. That the period is generally comparatively short is perhaps supported by the fact that hatchlings appear in April (Salsette) and early May, but later hatches are not uncommon. A recent hatchling was caught in my bungalow on 15-4-39, and another in the Prince of Wales Museum on 18-4-39.

Emergence of Hatchling.—I had the opportunity of observing the hatchling of 24-5-39 emerging from its egg. The procedure is as follows:—At first a small fragment of shell, barely a couple of millimeters across was slightly lifted—the snout of the lizard pressing against it—there was just space enough to allow air in. In this condition the egg remained for a few minutes; then followed a vigorous wriggling within the shell (the darker colour of the body could be seen against the thin shell) which fractured large pieces of the shell. These pieces fell away and the animal remained quiet for a couple of minutes before it finally left the shell, with the remains of the 'egg' still attached. At this stage the animal was very active. On emergence the first shedding of the skin takes place. The entire loose epidermis is clearly seen all over the body.

Egg-tooth.—On opening the mouth after the animal was put into preservative the double pear-shaped egg-tooth was clearly seen (see diagram). Only the two pointed ends of the pear-shaped bodies protrude *very* slightly, just enough to rupture the egg. The fresh egg-tooth appears somewhat hyaline. Prashad (*l.c.*) referring to the egg-tooth in *H. flaviviridis* remarks:—'No egg-tooth was to be seen on the head of the young ones.' Mahendra (*l.c.*) referring to the same 'organ' writes: 'Although I have examined several newly-hatched young ones, as well as ready-to-hatch embryos of *Hemidactylus flaviviridis,* I have not been able to find any trace of the egg-tooth, and I am, therefore, in a position to confirm

Baini Prashad's observation about its absence in this lizard.' That both these authors could not discover the egg-tooth in *H. flaviviridis* is not surprising for both evidently looked for it 'on the head' whereas in *H. flaviviridis* it is not on the head or snout, but fixed to the inner extremity of the upper jaw, and with the exception of the minute tip, is concealed between the jaws (see diagram).

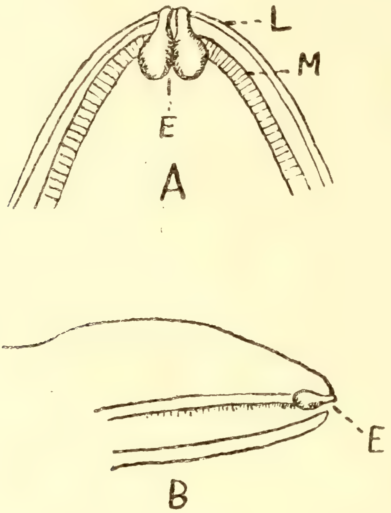


Fig. 3.—*H. flaviviridis* Rüppel.

A. Inner view of upper jaw showing egg-tooth in position.
B. Transverse section of head showing egg-tooth in position.
Both figures diagrammatic. E. egg-tooth. L. lip. M. maxilla.

Climbing powers.—Hatchlings spend a lot more time on the ground than their elders, of whom they appear afraid. A reason for this 'terrestrial' habit may be due to a weakness of the digital lamellae. Though the adults climb easily on glass, the young often experience difficulty. Mahendra (*l.c.*) also remarks on this weakness: 'but experiments show that it is not able to climb up vertical glass surfaces as most adults can.' In my experience the young do experience difficulty in climbing vertical glass faces when covered by a slight film of dust, but clean surfaces they easily manage. It seems from this that the film of dust prevents the lamellae from getting a firm hold. Nevertheless, this difficulty is soon got over with age. Growth is fairly rapid as no really small young are seen at the time when the period of hibernation is approaching.

Sexual variation.—Referring to the difference of size between the sexes, Prashad states, 'The male is much smaller than the female and is much more active and agile, in build also it is much slighter, and can be easily distinguished even from a distance.' My experience does not support any of these statements, the males are generally larger and are not less active than the females. Even in the hand the sexes are none too easy to distinguish, except during the breeding season when the protuberances of the hemipenis at the base of the tail (of course the femoral pores) are clearly visible. The fact that males may copulate with females larger than themselves may have given rise to the above conclusion, but there seems little doubt that old males are larger than old females.

Food.—Like most geckoes *H. flaviviridis* is mainly insectivorous, the young feed on smaller fry than the adults, but during scarcity, even adults will stoop to 'small game'. Even large moths, such as *Theretra nissus* Drury are swallowed. Mantids are also eaten, even the large green mantis *Hierodula coarctata* Westw., but in this case the gecko often comes off second best. Largish centipedes (*Scolopendra*) do not go amiss. In January (1940) I saw a gecko catch by the tail-end a cetipede two and a half to three inches long and immediately batter it on the ground. When the victim, which made several attempts to bite, was listless the lizard took it up a wooden panel and from time to time rebattered it as it tried to curve up towards the head of the assailant; gradually the whole centipede disappeared, the lizard wiped its jaw on the panel and then made off to its usual haunt behind a picture. Large insects are hammered against the surface till dead or nearly so, before being swallowed. This habit has often disturbed the slumbers of the inmates of a home and aroused the suspicions of the presence of a nocturnal visitor either material or ethereal! Protruding wings and whiskers are rubbed into the mouth by sideway brushings of the jaws. Frequently the jaws are rubbed against the surface after a meal, followed by the licking of the jaws, as in satisfaction. Once I saw this gecko catch a large spider in its web which was close to a wall. The gecko jumped at the spider, got it, but the web being strong enough to hold the gecko, it remained suspended with the spider in its mouth. The lizard wriggled to free itself and in its struggles dropped the spider; but later it managed to reach the ground, where it finished its well-earned meal!

Though the diet is varied, certain families of insects are left severely alone, among these are *Hemiptera* (Garden bugs), *Cantharidae, Dyticidae* and *Hydrophyllidae* (Water Beetles), (*Hymenoptera* (wasps and bees, though many ants are taken), certain *Carabidae* and *Lampridae, Ichneumonidae* (perhaps on account of their close resemblance to wasps), certain *Elateridae*—such as *Agripinis fuscipes* F., and certain moths. During the dry weather geckoes appear to drink water regularly. Every evening at dusk a particular lizard which lived in my room, went to a cup on the bathroom shelf and had a long drink before it started on its nocturnal rounds.

Gekko gecko Linn. The Tuck-too.

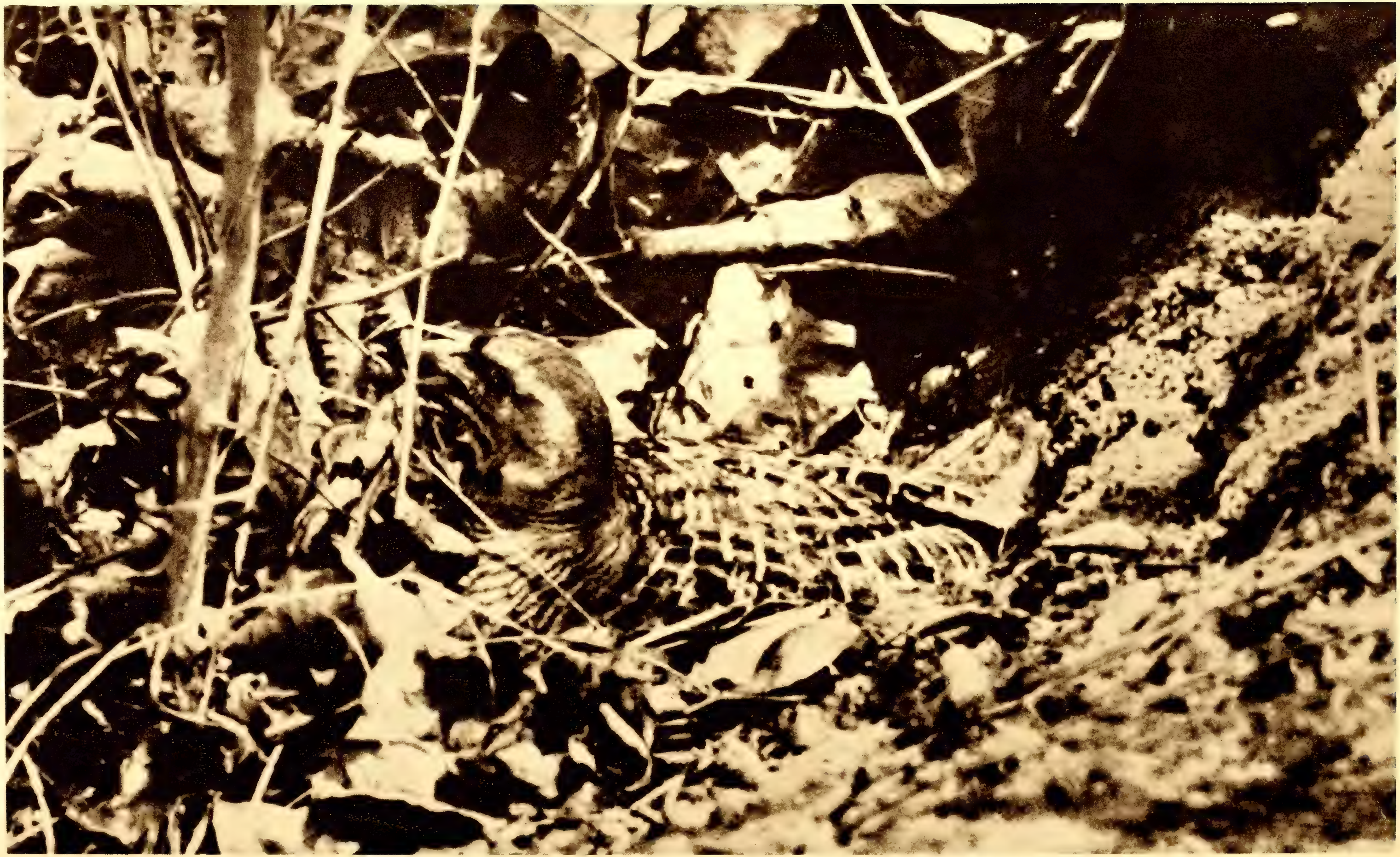
My first introduction to living specimens of this large and magnificent gecko was in Northern Burma, during the Vernay-Hopwood Expedition in 1935. During the early part of the trip I never saw or heard this animal; it was winter, but when we arrived at Maungkan (21-3-35) we heard the geckoes calling for the first time, all over the tea gardens. The call was unmistakable. As we descended the Chindwin the animals were a lot more vociferous and numerous. We secured several for the collection.

Colouring.—The young, like other gecko young, are differently coloured from the adults, the banding being most prominent on the tail. Not having made any notes at the time, I cannot refer to the colouration accurately. The adults have a wide range of colour, but the orange spots in rows across the back, particularly in freshly killed specimens, are very characteristic.

Habitat: They frequent houses, huts and trees and at nights are often seen on fence posts. In forests they live in holes or on the bark of trees. At Pantha, I found several living together, both young and old, in a hollow trunk on perfectly amicable terms.

Voice.—The call is loud and can be heard much more than a hundred yards away (as mentioned in the *Fauna*) especially in open forests. It may be divided into two separate parts, the first a *crock, crock,* repeated several times, followed immediately by the familiar *tuck-too* similarly repeated and which gives the animal its name.

(*To be continued*).



THE GREY PARTRIDGE.

Because I did not touch any twigs the sitting bird took no notice whatever of me.

NOTES ON SOME INDIAN BIRDS.

BY

E. H. N. LOWTHER, M.B.O.U., F.Z.S.

(*With* 8 *plates*).

V.—THE SPORTSMAN'S GALLERY.

(*Continued from page* 547 *of Vol.* xli, *No.* 3).

It must not be supposed that because an individual does not collect eggs, nor kills birds in order to determine to which species or sub-species they correctly belong, he therefore cannot shoot for sport. As a matter of fact I am a keen *shikari* and have had excellent sport after duck and partridge in the United Provinces in addition to spending many a happy day in Bengal and Bihar walking up snipe or having jungle-fowl driven. How hot it can be, how exhausting it is to squelch through the paddy fields after the crop has been cut, in quest of the 'long bills'; but oh! the joy of a 'right and left' and the thrill when the birds rise well and one is shooting straight. Many a mile also have I trudged along jungle path or sandy *nala* to take up a fresh position in a beat for jungle-fowl, and if at times I have felt that I simply could not put another foot forward, always I have enjoyed myself, and the hard exercise apart from giving me a hunter's appetite, has ensured a sound night's sleep. How much more relished too is the bird one has shot than the snipe or duck purchased in the *bazaar*! What memories also are revived of early awakenings and a snatched meal so that we can be on the *jhils* before dawn breaks. How cold it is at that early hour, how . . . But I digress.

In the present article the intention is not to tell of *shikar* adventures but to recount experiences when photographing some of the game birds resident in the plains of northern India. The number of species dealt with is small, not because there are not many other representatives but owing to the great difficulty in obtaining photographs of this family: many members readily desert their eggs if their nesting arrangements are interfered with in any way; others seem to possess a sixth sense which tells them of the hidden presence of the photographer, and, taken as a whole, the nests of the different game birds are not easily come by.

The game bird commonest *throughout the year* in those parts of India with which I am best acquainted is undoubtedly the Grey Partridge. It will be as well, therefore, to start with this species.

There are two types of country which, in my experience, the Grey Partridge favours more than any other for nesting purposes. The first is irregular ravines, neither narrow nor too deep, studded with light to medium scrub jungle, a *facies* which is characteristic of many parts of the Agra and Etawah districts, especially in the riverain areas; the second is light scrub land with *babool* trees intervening, and bordered by cultivation. A bush common in such country is a green, thorny kind of creeper—the *kareel,* I think—bearing small red flowers which, in February and March, are much patronised by sunbirds and migrating rosy pastors. Partridges regularly settle on these *babool* trees with the object of roosting in the branches, and it is under the different bushes, well concealed from view, that the bird lays her eggs. The nest is a small scrape, lined with two or three dead leaves, perhaps a bent or two, and possibly a few feathers from the bird's breast. Although up to nine eggs have been recorded I have never seen more than seven in a nest; commonly the full clutch does not exceed five in number. These are cream coloured. The hen sits closely and although I have on several occasions been within an inch (as it were) of photographing her, it has always been the removal of the *last* twig in order to obtain a perfectly clear view of the bird that has ruined my chance of success. The signs have invariably been the same: the bird suddenly running off the nest, and then a whir of wings. I believe, regretfully, that in every single instance the partridge never returned to her eggs. Every rule, however, has its exception, and I have met this once, and once only, in the case of this species. Sakroo had observed that the owner of the nest in question was absent for approximately an hour and a half every day between 6 and 8 a.m.; while she was away he had from time to time removed a few twigs and gradually introduced the hiding tent nearer to the nest. Photography was, in his opinion, now possible—would I come at once? Such an opportunity was not to be missed and I was soon on the scene. Because I did not touch any twigs the sitting bird took no notice whatever of me even though I was in full view of her while actually making the exposures. It would appear, therefore, that the only sure method of photographing this species successfully at home is to wait till the hen has left the eggs and then proceed in the manner adopted by my *shikari.*

I am acquainted with only one species of Spur-Fowl, the Painted Spur-Fowl. This occurs throughout the Chota Nagpur division wherever there are hills or rocky ground well covered with bamboo or other jungle. The bird is a great skulker and in a beat will seldom take to flight, preferring instead to run either *across,* with the object of getting away between the beaters and the guns, or to slip down some wooded *nala* and along the foot of a bank, sometimes singly, but more often the pair together.

The Painted Spur-Fowl likes to be well out of sight when incubating and therefore lays her eggs either in a recess under the roots of some tree growing on a bank, or deep under an overhanging rock on a hill-side. Another favourite nesting site is in the heart of a thick clump of bamboos at the foot of which dead leaves have collected. No nest worth mentioning is made, the three or four buff coloured eggs, rather smaller than those of the country fowl, lying in a scrape with, perhaps, a few leaves collected round about, probably more by accident than design. The photograph of Sakroo looking down on to an incubating Painted Spur-Fowl gives an excellent idea both of the habitat of this species and of a typical nesting site.

THE PAINTED SPUR-FOWL.

Rocky ground and bamboo jungle—
a typical nesting site for Painted Spur-Fowl.

The only exposure I ever succeeded in making was of a
female walking on to her eggs.

Although the Painted Spur-Fowl sits very closely, in such dark places does the hen usually lay her eggs that I have never been able to photograph her on the nest. The only exposure I have succeeded in making was of a female walking on to her eggs. My hopes that the bird would take up a position more suitable for my purposes were frustrated by her unexpectedly turning away more sharply from the lens than I had anticipated so that when finally I released the shutter the beak and eye were lost to view. What a fright the noise of the shutter gave the Spur-hen ! She just jumped and scuttled away, and although she hung around, clucking, would not return to her eggs. At the end of two hours I abandoned the idea of taking further photographs, and removing the camera, etc. made myself scarce. My relief was great when, passing by early the same evening, I noticed she was sitting again.

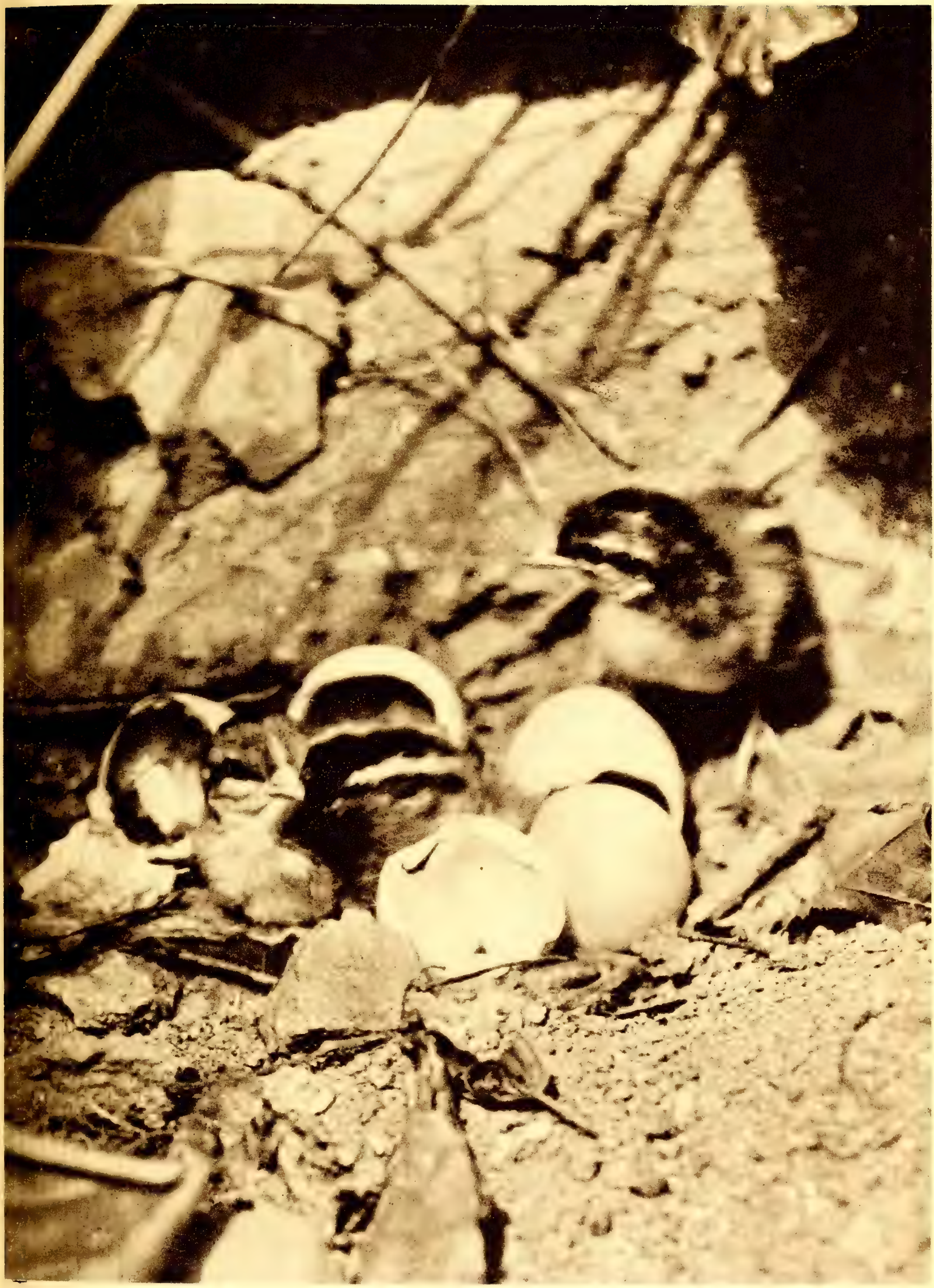
Writing of the Painted Spur-Fowl reminds me how very different in temperament members of the same species can be. On 29 May 1935 I investigated a bundle of hay lying within five yards of the road that encircles the reservoir at Topchanchi, twenty-two miles distant from Dhanbad. Within three yards of each other, in cavities under this, a Red Jungle-Fowl and a Painted Spur-Fowl were incubating three and four eggs respectively. The former deserted because I had almost trodden on her. Not so the Spur-Fowl, and as her eggs were at the edge of the hay I entertained great hopes of photographing her. My *shikari* knew the habits of the species well and during the next two mornings cleared the way for photography while the female was absent feeding. Unfortunately the *hide* had not been placed in quite the correct position, and equally unfortunately, the Spur-Fowl was incubating when I arrived on the scene on June 1. Long before I had fixed matters up to my liking she had run off and disappeared into the jungle. Nevertheless, I felt hopeful of success. During the next two hours or so she walked all round me, once or twice even pecking at the hay used on the outside of my tent, her presence made known all the time by the crinkling of leaves. Occasionally too I obtained a glimpse of her. I felt she must, every minute, walk on to her four eggs, and was keyed up to concert-pitch. Alas ! she scented me or some instinct told the bird MAN was now inside the strange-looking bush, and again I failed in my object.

The same evening (June 1) Sakroo found another Painted Spur-Fowl's nest, high up on the hill-side overlooking the reservoir, the one into which he is looking in the accompanying plate. The *hide* was set up beside the nest and as he reported the following day that the hen was sitting and not in the least afraid of the tent, I decided to try my luck once more. June 3, therefore, saw me toiling up the precipitous hill, pausing constantly to mop my brow and regain my breath. Seldom have I felt so done as when I reached the nesting site: I lay in a state of collapse for half an hour or more before I could rouse myself to investigate matters. The Spur-hen was at home, sitting tight, *very tight*, looking straight at me, her body sunk into the slight depression of the nest and with feathers fluffed out so that she appeared more like a Jungle-Fowl in size. It seemed clear that the eggs must be near hatching. At first I thought of taking a time exposure of her but gave up the idea, as only with difficulty could she be seen with the naked eye, while she did not show up at all on the ground-glass. I therefore set up the *hide,* intending to put the Spur-Fowl off the nest and obtain her portrait as she returned to the eggs. But it was of no use, and whereas the bird I had attempted to photograph on June 1 would not return to the nest, this individual absolutely declined to leave her eggs. Debating in my mind the queer ways of the *female of the species,* I left her in peace. I derived no little satisfaction a few days later when I discovered from a close inspection of the nest that the eggs had hatched successfully. A week previously that particular hill-side had been scoured from top to bottom by one hundred or more Manjis (the local savage), everything being killed or taken which they came across. I had seen their 'bag' which included snakes, lizards, iguanas, tree rats, two long-tailed nightjars, a pitta, two kinds of doves, dozens of birds eggs, and a wild pig. But the Spur-Fowl's home escaped detection, a fact which speaks volumes for Sakroo's ability to find nests.

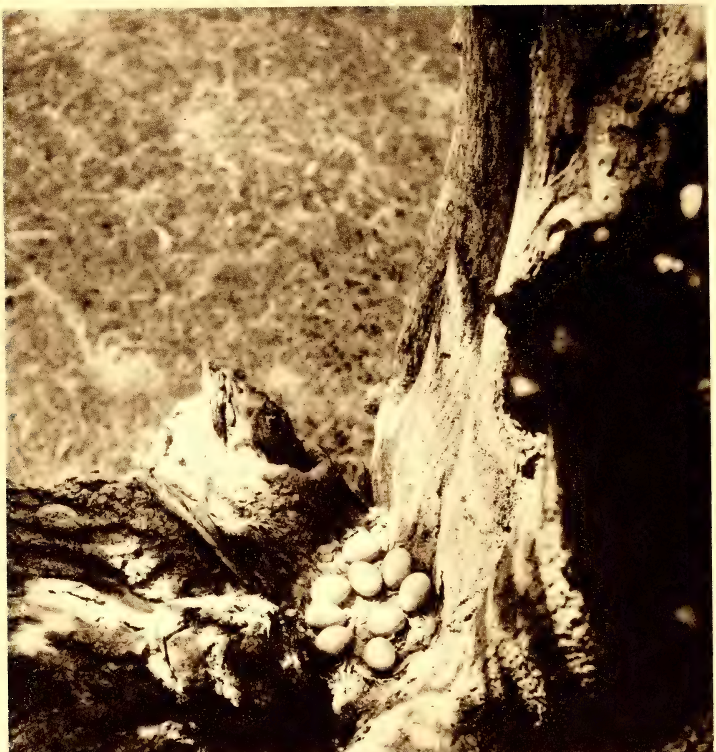
The Red Jungle-Fowl is not so secretive in its choice of a nesting site as is the Painted Spur-Fowl; not that the nest is not well-hidden, because it is—often in a tangled thicket in a jungle *nala.* What I would imply is that occasionally this species nests in fairly open situations, under a bush or sapling, amongst a carpet of leaves, but always in some sort of jungle, and usually on a hill-side. When first I found a nest in such a situation I entertained great hopes of photographing the Jungle-hen at home, but was soon to learn that some sense tells these birds that Danger is lurking round the corner, so to speak, when I am inside the hiding tent, so that I have not yet taken a single photograph in spite of the fact that I have tried my luck with more birds than I have fingers on two hands. So wary is the species that I have not known the hen come anywhere near, even when she was absent foraging when I arrived to set up the camera in a *hide* to which she took no exception when this was unoccupied.

If anybody succeeds in photographing the Red Jungle-Fowl incubating he will have obtained a really valuable prize. Some real attempt appears to be made by this species at nest-building as in addition to the eggs lying in a hollow these often repose on quite a substantial pad of leaves. Three to six eggs are laid, five, perhaps, being the most usual number. These vary from cream to buff in colour and are about the same size as the *desi murghi's* eggs which we are accustomed to have served up for breakfast every morning.

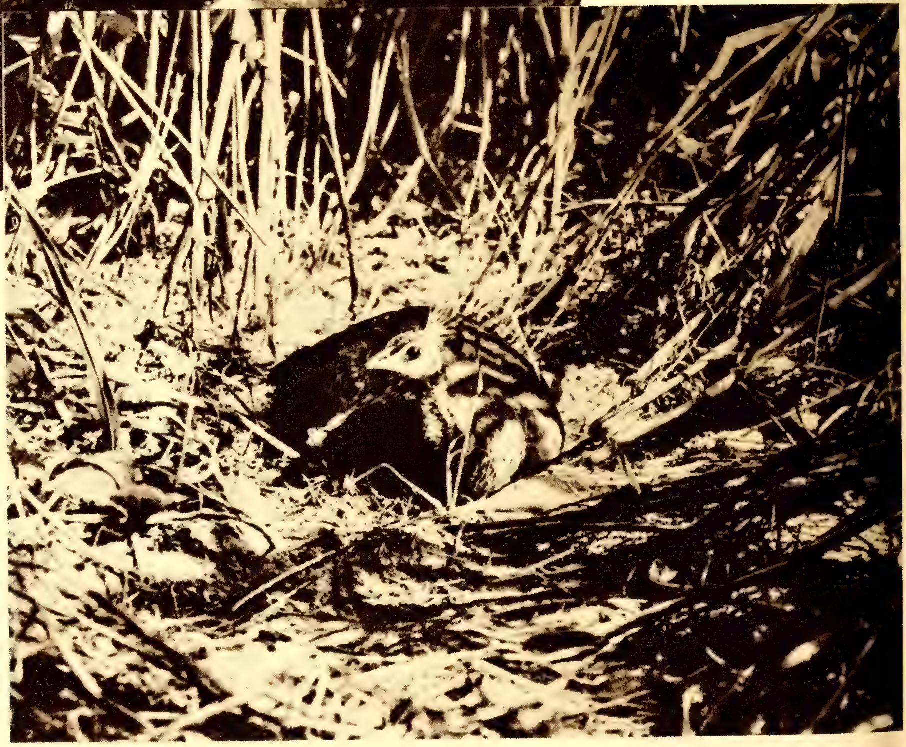
On one occasion I imagined I was bound to obtain at least one photograph of a Red Jungle-hen on her nest. The *hide* had been in position three or four days and been moved gradually nearer to the sitting bird. When investigating matters on a Saturday evening I discovered that two of the eggs were chipping. I visited the nest again before six the following morning, but as I approached, the hen ran off, followed by the chicks, which took cover in different directions, the mother subsequently flapping about from



RED JUNGLE-FOWL CHICKS.



PEAHEN'S EGGS IN A TREE.



A PEAHEN INCUBATING HER EGGS.

time to time and clucking repeatedly. This was in fairly open jungle well covered with leaves. An addled egg remained in the nest, and other evidence of the successful hatch.

After a prolonged and very careful search—we were naturally afraid of treading on the young ones hidden under the leaves—two chicks were found and replaced in the nest. My patience was thoroughly tried taking their photographs, because no sooner had I succeeded in quieting one than the other decided to run away; and so on it went for well over an hour, during which time I made six exposures. Such, however, is the perverseness of wild creatures that when I had packed the camera in its case and folded up the tripod, the young ones refused to leave the nest and remained perfectly quiet! More remarkable still, when I walked away they followed me for a distance of several yards, so that I was compelled to retrace my steps and place them back in the nest. But this was not all; when, the second time, I had proceeded an even further distance, something made me look round, and there were the two chicks following me again! This time I put them under a bush into which I had last seen the hen disappear, and so succeeded in getting away unaccompanied.

Although the adult Red Jungle-cock is a gloriously handsome bird with his golden-orange-red hackles, deep chestnut back and rump, chestnut coloured wings, and green and purple glossing, I consider he must give way for sheer beauty to the chick. This has what is described as 'a broad plum-brown coloured band extending from the crown to the tail, enclosed in lateral bands of buff, a plum-brown coloured line passing through the eye and down the sides of the neck. The sides of the body are rich warm reddish-buff changing to pale-buff on the chin, throat and centre of the abdomen.'[1]

It is surprising how, sometimes, the bird photographer allows to slip by opportunities of portraying at the nest a species which occurs commonly in his neighbourhood, only because of his anxiety to photograph some other species, with the result that only too often the species coming under the first category remains unphotographed due to an unexpected transfer, or for some other similar reason. These remarks are prompted by an inspection of my photos (taken recently) of a Peahen incubating her five eggs. During the long years when I was stationed in different parts of the United Provinces in the earlier part of my service numerous nests of this species came to my notice, many of them in fairly open situations, so that if I had taken a little trouble I feel I ought to have succeeded more than once in photographing the bird at home. Always, however, I had some other subject in mind at the time and put off making the attempt until I had more leisure for the purpose, with of course, the inevitable result. When, therefore, I found myself back at Allahabad in 1938 I made up my mind to leave no stone unturned in an attempt to photograph the Peahen *chez elle*. The bird, however, turned out to be a far more difficult subject than anticipated, even though its nest, a hollow scraped in the ground and lined with two or three straws, was situated in a *bajra* crop close to a village which it is not improbable the bird was in the habit of visiting at other seasons for roosting purposes. The *hide,* as usual, was first placed at some distance from the nest, and moved nearer the following morning. The Peahen was allowed to incubate for some hours and had apparently accepted the new situation. But in the afternoon, when the lens was introduced, she gave ample proof of what a shy bird this species can be, and walked round and round the nest before finally settling down. Although I did not photograph her for some considerable time, even then the Peahen was all suspicion. The noise of the shutter going off the second time caused the bird to leave the nest for nearly half an hour, and when finally she returned, it was not to settle down but to move the eggs further away and rather to the side, a distance of nearly five feet. This she did by levering them towards herself with the chin applied to the far side of each egg, and moving backwards. No further attempt was made to photograph the bird and when my *shikari* turned up to release me, the Peahen was sitting the eggs hard in the new 'nest'.

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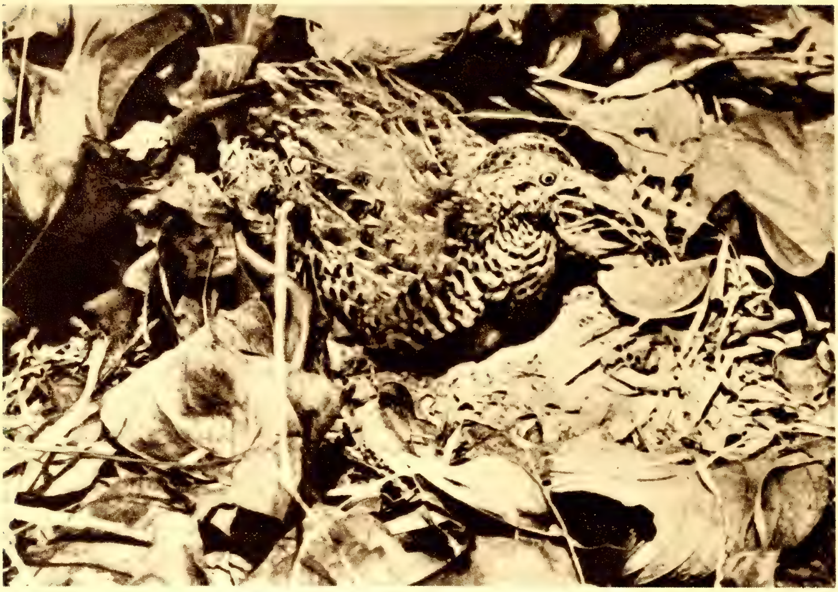
[1] *New Fauna*, Vol. v, p. 297.

Peahens usually lay from three to five eggs; clutches of six eggs, however, are not uncommon. Normally these are laid on the ground, in some standing crop, or in a thicket. Occasionally they are deposited at some height from the ground, as for example, in an old nest of a vulture. I myself once came across a Peahen's nest in a mango tree, about twelve feet from the ground, in the space formed by the junction of a number of branches with the main trunk. Not only was the site unusual but the 'nest' contained *nine* eggs. I have also seen a perfectly wild Peahen incubating her three eggs under a pile of faggots placed on the roof of a hut in the centre of a village. Another nest of this species which I inspected was situated in the heart of an aloe bush alongside the railway line. Passing by again a few hours later I was surprised to see a wild cat jump out of the bush. Only one of the five eggs remained and the shell of this also had been perforated by the animal's teeth.

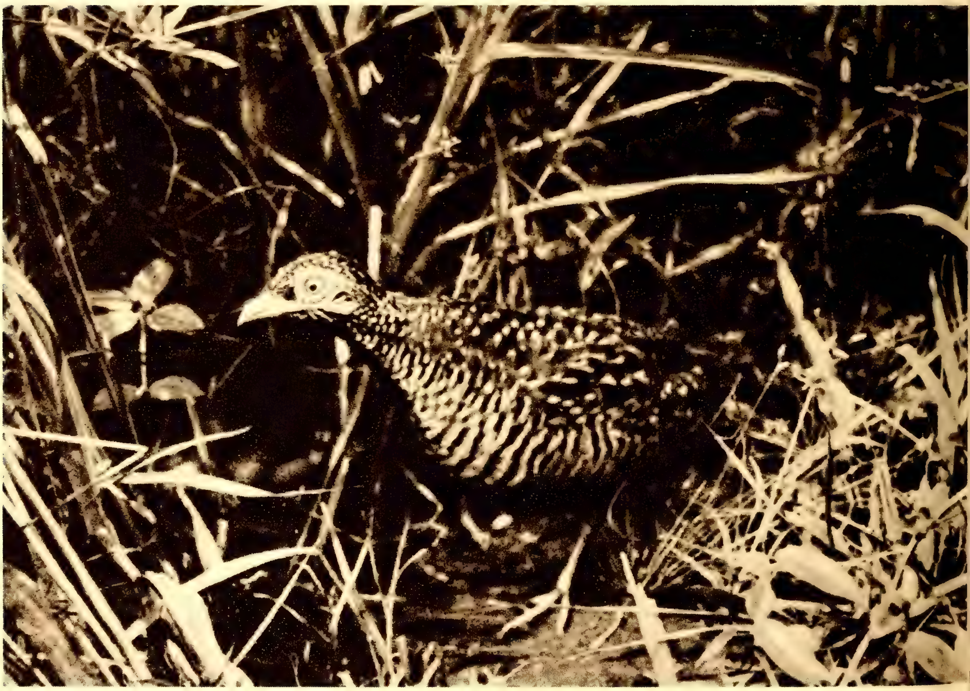
In northern India Peafowl are considered sacred, which accounts for their occurring in such numbers in many places, and being so tame. There they frequent the fields in the immediate vicinity of man's habitation and even roost in village trees. How inordinately shy though is the species in those parts of the country where it is not sacred and where, as throughout Chota Nagpur for example, everybody's hand is turned against it. Here the Manjis and Kols regard it as a particular prize, and the *sahib* too considers himself fortunate when he brings one to bag. Suspicion and cunning are written on every look, on every movement of Peafowl, in districts where they are hunted, and it is remarkable, if any are in a patch of jungle that is being beaten, how successful these birds usually are at evading the guns.

Everybody is familiar with the Peafowl's normal call, a loud, screaming *mee-ow;* few, however, are aware that it has another note which sounds as though somebody were blowing down a reed.

THE COMMON BUSTARD-QUAIL.



It is the male alone who attends to the incubating of the eggs.



A female approaching the nest.

To the best of my recollection, this is heard only in the breeding season, that is to say, during the rains.

The Common Bustard-Quail is a very small bird, smaller even than the Common Quail, and occurs more generally than is imagined; in many parts of Chota Nagpur it is definitely common. In addition to having two distinct nesting seasons—the beginning of the hot weather, and again from the middle to the end of the rains and even later—this species is remarkable for its breeding arrangements. The female is larger and more handsomely coloured than the male and appears to 'wear the trousers' at all times. I have tried hard to learn which of the two builds the nest but have no ocular evidence. I believe, however, from the manner in which the female completely dominates her husband, that to the latter must fall this task. At all events it is the male who alone attends to the incubating of the eggs and the bringing up of the young, the female, as soon as she has laid four eggs, finding another husband and planting a further clutch on him; which pleasant diversion she keeps on repeating until she cannot find more mates—or possibly till she is tired of laying more eggs. There is considerable variation in the colouring and markings on the eggs of this species; these, however, run the same not only in the one clutch, but in different clutches in the same area, the inference being that they are all laid by the one bird in each area. In this connection I should state that the female Bustard-Quail is a great fighter and will not tolerate the presence of another of her sex in the area she considers her own. In support of this statement I may add that one day I saw five nests of this species in two widely separate areas. The eggs in three nests in one area had clearly been laid by one and the same bird while those in the other two nests were obviously the product of a second female.

I have twice photographed the male Bustard-Quail at home and found him to be of a nervous, timid disposition although not afraid of facing the camera. On one occasion the nest was at the foot of a large bush, under a straggling tussock of grass surrounded by leaves. The first lot of photographs not being particularly successful I returned to take more, to find that the Bustard-Quail had rolled the eggs out of the nest and that these were now about two feet away from their original position. I had not been two minutes in the *hide* when the male returned and at once covered the eggs. He was, however, obviously ill at ease—it was certainly not the hiding tent that worried him because this had been in position five days—and kept running off, only to return, the bill open all the time. Later he rolled the eggs still further away from me, using his bill for the purpose. Then he rolled them in my direction, again away from me, and finally to the side. He continued to do this even after I had removed the *hide*.

It was only after trying for three whole seasons that I succeeded in obtaining a photograph of the female Bustard-Quail. The nest at which the hiding tent had been erected contained an incomplete clutch and I hoped to photograph the female as she walked on to the nest to lay the last egg. When I arrived Sakroo informed me that she had been wandering all round the nest, accompanied by the male, and that he had had some difficulty in keeping her from going on. I therefore anticipated—and obtained—a quick photograph. Not only is the black band down the centre of the neck clearly shown in the accompanying plate but the photograph conveys a vivid impression of anger—anger at having been prevented from going on to the nest. In addition it will be seen that the bird possesses no hind toe, a feature which at once distinguishes all representatives of this family from the true Quails. The noise of the shutter so alarmed the female that she did not return to the nest but instead laid the fourth egg in the grass about six feet away. This did not, however, prevent her from chasing the male round and round, till finally he came to the conclusion that discretion was the better part of valour, and settled down to incubate, looking, I thought, the picture of abject misery. Five minutes later I could hear the female calling, the sign to males that she was in search of another husband. The call I can only liken to the hum of an aeroplane in the great distance, or a motor cycle being started up, also far off—*kurr-r-r-r-r,* continued for some time. That of the male is entirely different—*pook-pook-pook-pook.*

Although the *New Fauna* states that the Jungle Bush-Quail occurs in well-wooded localities from the Himalayas to Ceylon[1], I have come across this species only in the Manbhum and Hazaribagh districts.[2] There, if not abundant, it is by no means uncommon although local, and several times I have been startled by one of these birds suddenly rising only a yard or two in front of me with a great whir; and as I have followed its flight, been still further alarmed by three or four more getting up from almost the identical spot, each, however, usually flying in a different direction for a short distance before dropping into the undergrowth again.

The Jungle Bush-Quail is a gregarious creature, for not only do numbers feed together, even in the nesting season, but at times several pairs breed in close proximity to each other. In October 1935 I had four nests of this species under observation, all within a thirty yards circle, in a patch of *tulsi* surrounded by fairly heavy scrub jungle. Year in and year out this particular spot was a sure find for eggs of the Jungle Bush-Quail, and in two other similar patches not two hundred yards distant we could always bank on finding one or more nests. The eggs, which are a creamy-white in colour, number from five to seven as a rule, and rest on a pad of grass in coarse grass at the foot of the *tulsi* and other plants. The breeding season is from about the middle of August to the end of November.

As in the case of the female Bustard-Quail it was only after three seasons of constant endeavour that I succeeded in photographing the Jungle Bush-Quail at home. Sometimes it was a rat, at others a snake or other enemy that had eaten the eggs; on one

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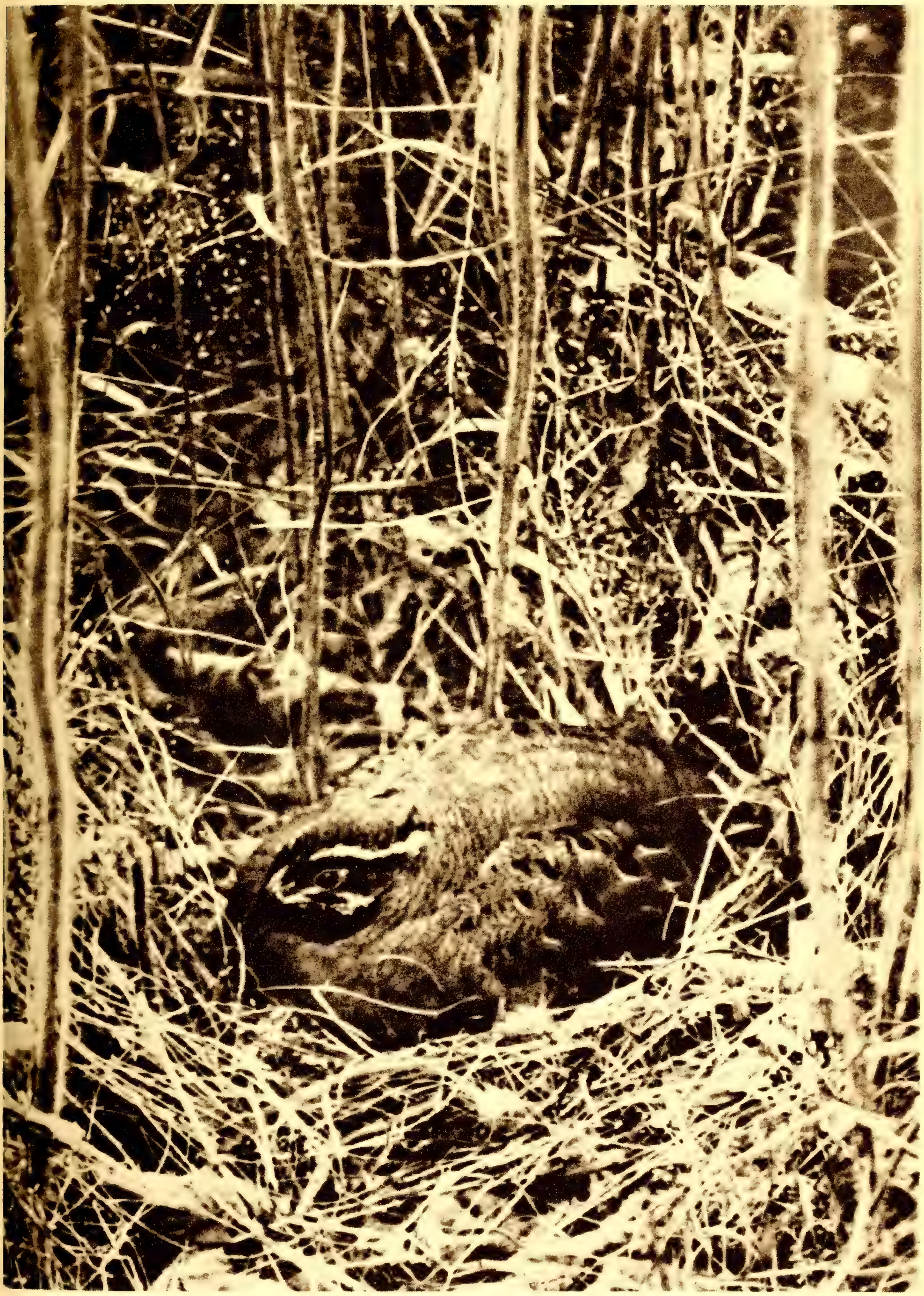
[1] Vol. v, p. 378.

[2] I have since found it common in the Mirzapur and Etawah districts in the United Provinces.



THE JUNGLE BUSH-QUAIL.

occasion a buffalo had 'put its foot into it'; on another the young hatched out before an opportunity presented itself of attempting photography. When, therefore, October 1935 came and I had not yet photographed the species and everything pointed to this being my last nesting season in the Manbhum district, added to which I knew that I could not stand the heat and inconvenience of the hiding tent much longer in the plains of India, I made up my mind to photograph the Jungle Bush-Quail *now*—or the opportunity would for ever be lost to me. Accordingly, we concentrated on the species, and it was not long before my *shikari* telephoned that he had found four nests—those referred to in the preceding paragraph. However, it was not until we had placed the *hide* before the third of these that Fortune smiled on us at all, rats or that arch enemy MAN having destroyed the contents of the others, including the eggs in the fourth nest, near which the tent was never erected.

Between October 27 and November 9 I spent six days trying to or actually photographing the Jungle Bush-Quail. I shall not attempt to recapitulate my experiences on each occasion or tell of my failures until November 6, when, changing my tactics, success at last came my way; to do so would only bore the reader. Instead let me outline what I learnt of the nesting habits of the species and the steps taken to correct my initial mistakes. To begin with, the Jungle Bush-Quail, like other game birds, left her nest early every day in order to feed, and was absent for this purpose for approximately two hours between 6 and 8 incubation thereafter continued until about 10-30 when the male approached—though I never saw him—uttering a sibilant *sirr-r-r-r-r-r,* much like one of the notes of the common iora, for which, as a matter of fact, I mistook it at first. The female then left the nest and did not return till the sun was at its meridian. Again she incubated until between 3 and 4 p.m. when, on the male again arriving and calling as he did earlier in the day, she once more left the eggs, this time for a shorter spell of between forty and sixty minutes.

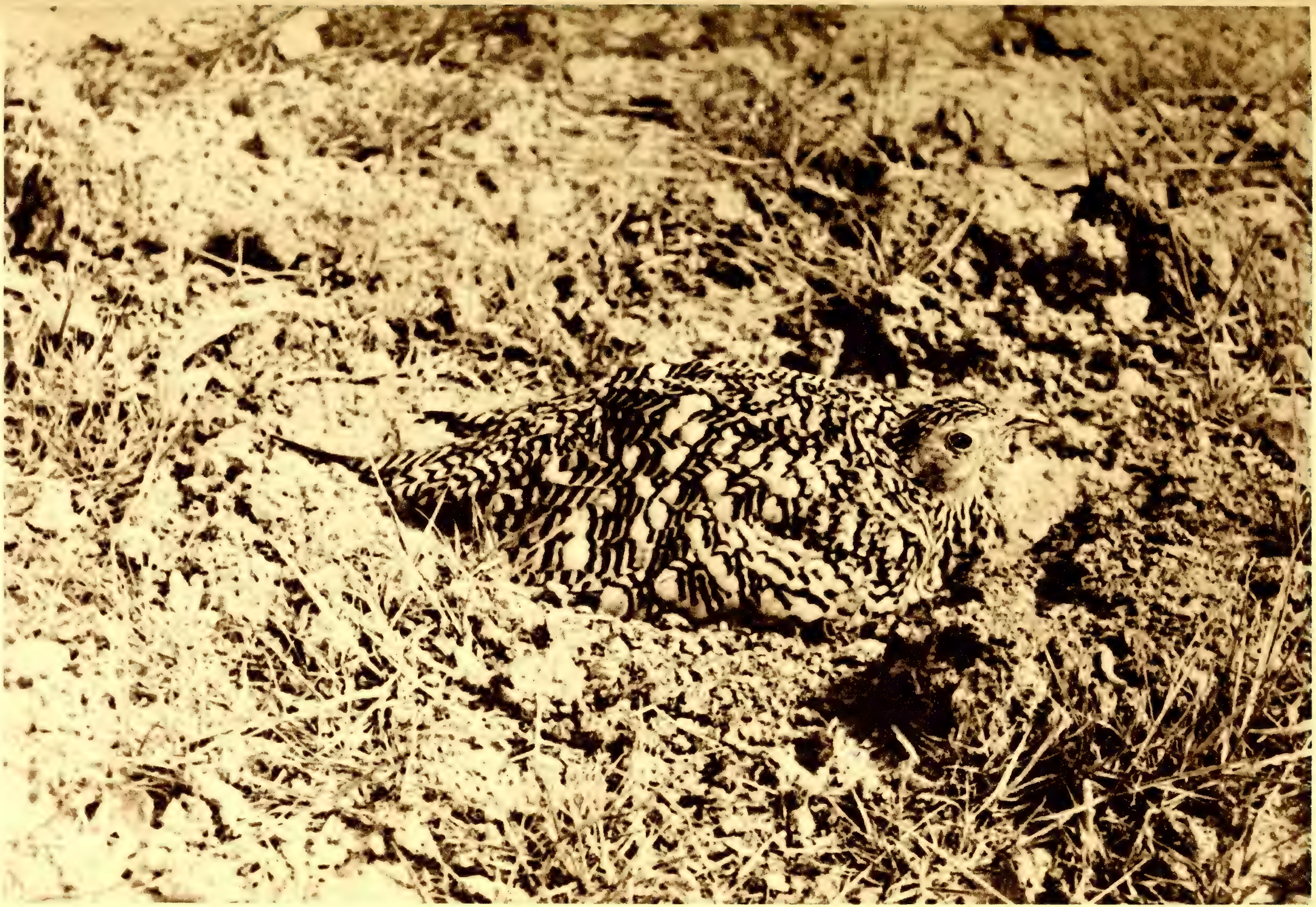
I do not suggest that all Jungle Bush-Quails work to the same time table; indeed, even my bird varied this on one occasion by going off at 10-30 and not returning till after 3-00. Except once, when the noise of the shutter frightened her rather badly, these prolonged absences were entirely voluntary and must, I think, have accounted for the eggs having taken so long to hatch. The nest when found on October 15 contained two eggs, this number being added to on alternate days, so that the clutch was completed on the 21st. Three eggs hatched out during the late afternoon of November 11, and all five had done so when the nest was visited for the last time the following morning. As the female did not sit until the full clutch was laid incubation lasted from twenty-two to twenty-three days, which appears to be inordinately long for so small a species; under normal conditions I should think that eighteen days would be sufficient.

The real difficulty in photographing the Jungle Bush-Quail was that the *tulsi* patch, at the foot of which was situated the nest, was some two and a half feet in height. To cut this down in a small circle so as to expose the nest entirely was quite out of the question, as to expect the bird to return to her eggs in the circumstances would not only have been gross cruelty—she would almost certainly have deserted—but a photograph (if obtained) would have given a wrong conception of the nesting site, and of the deep shade in which the female incubated. What I did was to make a narrow lane down which the lens looked on to the nest. There was a great drawback to such an arrangement—very little light reached the sitting bird, the result being that in spite of my using the largest stop I could and working at only 1/25 second the few photographs I obtained during my first four days were hopelessly under-exposed. It was on November 6, therefore, that I decided to take my courage in both hands and try for time exposures instead, about 4-30 p.m., when I knew from previous observations that the Bush-Quail would be settled down for the night session. This, however, meant long exposures because I was determined to do the thing thoroughly—use the smallest stop in order to obtain the greatest detail. To make matters worse, the sun by this time had gone below the hill behind me. It remains only to add that although the camera still remained inside the hide, I worked it from outside, standing less than five feet away from the sitting bird, and that except when the shutter was released for the first time, she did not move a muscle. The photograph reproduced here was a forty-five seconds exposure taken with stop F 22,—on a Panchromatic Special Rapid Plate.

I am certain this Jungle Bush-Quail would never have hatched out had I not employed a *chowkidar* to keep watch over the nest all day and every day till late in the evening, until the young actually left their prisons.

I have omitted to make mention of one matter, the normal call of this species. To me it sounds very like *pity-pity-pity*.

March, April and May are the months in which to search for the eggs of the Common Indian Sand Grouse. Fallow fields and wide expanses of *maidan* on which saltpetre exists, with a scanty outcrop of short, coarse grass obtaining, are greatly favoured by this species for breeding purposes. Nest there is none really, the three long, cylindrical-shaped eggs, dark greyish-yellow in colour, spotted and blotched with reddish-brown, with underlying markings of a light purple shade, resting on the bare ground under no shelter of any description. Wonderfully though this bird harmonises with its surroundings at all times, never does it do so better than when covering eggs. Consequently the nest is a most difficult one to discover. But having located one the photographer's troubles have only just started, because the Common Indian Sand Grouse, like the Grey Partridge, readily deserts her eggs if her nesting arrangements come under too close investigation: once she has been flushed off the nest the Sand Grouse will not return to her eggs. Such at all events has been my experience on a number of occasions, an experience all the more exasperating as each time I had the bird beautifully focussed, and had only to pull out the slide venetian, and release the shutter to obtain the Sand Grouse's picture, when off the bird has flown without giving warning of



COMMON INDIAN SANDGROUSE.

any description. In each instance the eggs were fresh, so pondering the matter it seemed that the only chance of meeting with success was, next time, to let the bird continue to incubate for a week or ten days before attempting photography. The plan worked excellently and in the end, with my last plate, I photographed the bird at a range of only six feet from the lens. Then only did the Sand Grouse leave her nest, to trail apparently broken wings and feet before me. As I examined the eggs, one of which was already chipping, she remained quite still, but as I retreated she resumed her tactics, moving away the whole time till she had gone about fifty feet from the nest, when she fluttered into the air, and landing near the eggs, at once rushed to sit them.

Another Sand Grouse's nest which I was shown was situated amongst *kanker* lying on somewhat uneven ground, and was only eighteen feet away from the track carrying the East Indian Railway main line from Calcutta to Delhi. It is strange the bird should have selected such a spot when wide stretches of fallow fields were immediately at hand and apparently more suited to her purpose. Perhaps she enjoyed the noise of trains thundering past her day and night—some peculiar people do.

At the time of my inspection two of the eggs had just hatched and the young already vacated the nest which was now swarming with small black ants. Looking round I saw the female Sand Grouse not ten yards away, with a nestling sheltering against her. She was joined presently by the male bird while I was photographing the chick. Together they ran first in one direction and then another but finally the male took wing and flew out of sight. Shortly he returned, to settle some way inside a field. At once he called, and as I had by this time finished camera operations, he was immediately joined by his wife and child, the chick remaining between its parents (who lay surprisingly low) until I had taken my departure. The other chick I never saw: perhaps it had already fallen a victim to one of the numerous enemies of all ground-nesting birds.

I noted at the time that the Sand Grouse nestling is 'light reddish-brown above with much light buff markings, most pronounced on the head. Underparts white or buffish-white' but I expect the *New Fauna* describes the colouring more accurately: I therefore quote Mr. Stuart Baker's remarks:—'Above pale ginger broken by white patterns and lines, picked out in black; underparts isabelline-white, darkest on the throat; the pattern on the head and on the back assumes the shape of a figure of eight'[1].

Four species of ducks breed commonly in the plains, the Nukta, Lesser Whistling Teal, Cotton Teal and Spotbill. I have personal knowledge of the nesting of only the first two. On the extensive Boran *jhil* in the Bhagalpur district, on the right bank of the Ganges, the Lesser Whistling Teal used to breed commonly; perhaps it still does so. One nest I found was in a hole of a tree standing in water, and as I counted the twenty-four eggs in the cavity the teal splashed about, striking the water first with one wing, then the other, and finally with both, just in front of me, obviously trying to decoy me away. Occasionally the eggs rested on a fallen-down collection of sticks, about five feet above the water, probably the old nest of an open-bill. Most often, however, they reposed in a nest of coarse grass built by the teal on the floating islands of grass and weeds which were a feature of this *Jhil.* Always over these nests was an awning to conceal the sitting bird. The boatmen knew this type of nest so well that frequently as the 'whistler' flew sluggishly off her eggs, they knocked the bird down with the long pole with which they propelled their flimsy craft. Once only—in the Mainpuri district—have I seen a nest of this species on the ground; this was built on a narrow, grass-grown *bund* of a small tank, about five yards from the shore. I have not seen down incorporated in a single nest and believe the bird dispenses with this luxury altogether.

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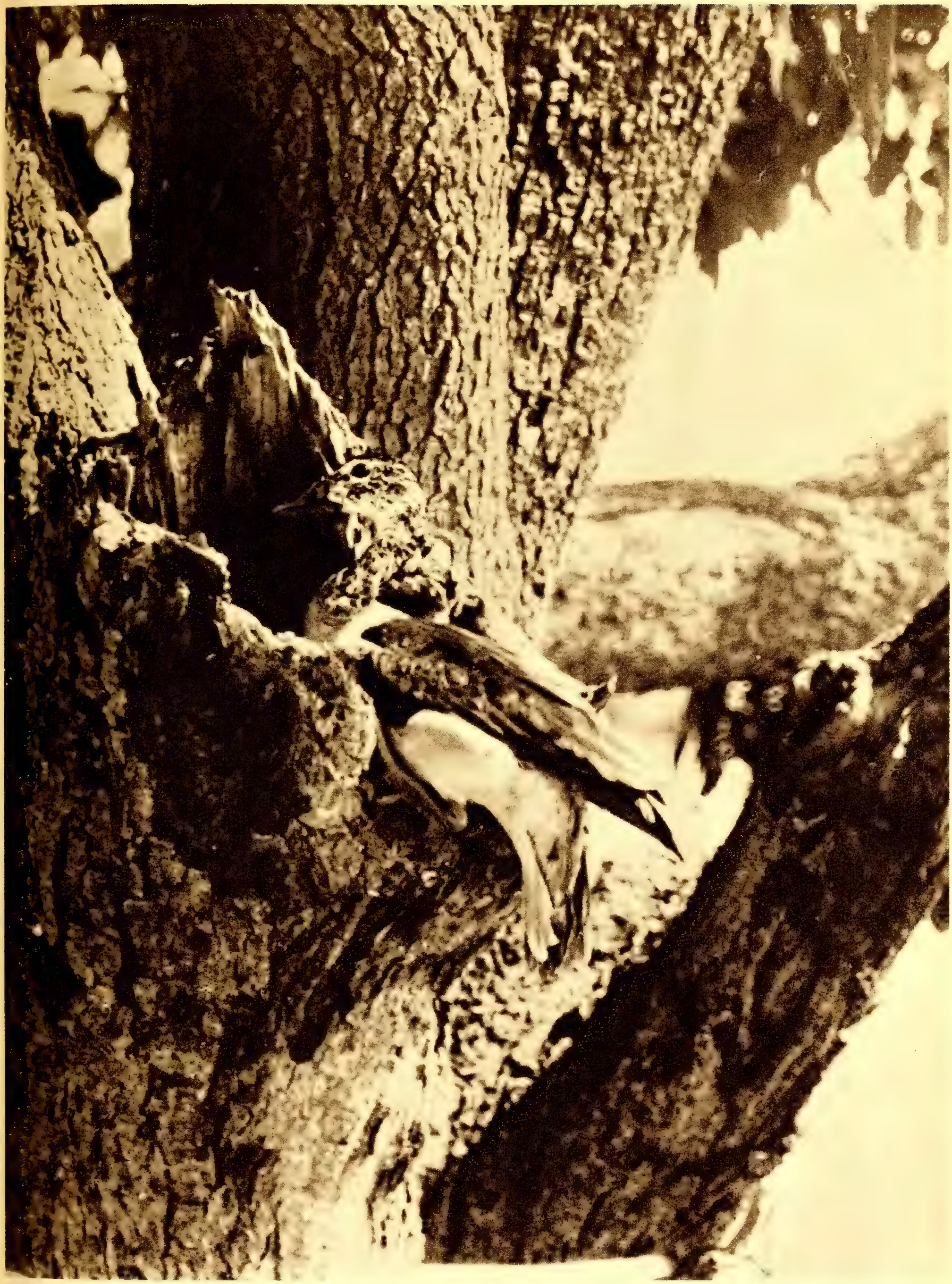
[1] Vol. v, p. 272.

Both because of its large size and owing to its beak being low at the tip and high at the base the layman may well be forgiven for terming the Nukta a goose and not a duck. Normally the bird goes about in pairs, the drake noticeably larger than the duck and possessing also a large knob on the upper mandible which becomes even more pronounced with the approach of the nesting season, a knob looking like an inverted swarm of bees, the type which hangs dangerously at the entrances to old Moghul buildings. At the close of the nesting season, however, I have occasionally seen parties of fifty and even over one hundred Nuktas paddling about near the weedy margin of a favourite *jhil* round which grew many mango trees, the tree most favoured by this species for breeding purposes. The nest is generally built in a hole but sometimes in an open position in the considerable space formed where two or three large branches radiate from the main trunk, and is usually situated at no great height from the ground, twelve to fifteen feet being the average. It is made of sticks and grass but as the bottom of the nest cavity may be three or four feet from the entrance, as was the case with the bird whose photo is here reproduced, it is not always an easy matter to say how many eggs have been laid; at one moment it appeared that this particular nest contained twelve eggs but five minutes later fourteen. Normally I think eight to ten are laid but as many as forty-seven have been recorded, not improbably the produce of two or more birds. These are of an ivory colour when first laid but soon become discoloured with incubation. The breeding season extends roughly from the middle of July to the middle or end of September.

With the exception of the Red Jungle-Fowl, no bird with which I am acquainted, not even the water-rail, is more shy or suspicious in the approach to the nest than the Nukta. Nor is this surprising if we remember that once the duck is inside the nest cavity she can easily be caught: a fate which only too often the bird meets with at the hands of villagers, to whom its nesting habits are usually well known.

From the time that the duck perches on some thick branch high up on the nesting tree, apparently for no other reason



THE COMB-DUCK OR NUKHTA AT ITS NEST.
Mango trees are most favoured by this species.

than to rest or preen herself, till by slow degrees she enters the nesting cavity, always travelling by the same route and after each stage in the journey preening herself again or looking round nonchalantly, it is nothing unusual for an hour or more to pass. There is nothing clumsy about the bird's movements as she flies down from one branch to another, nor does she give one the impression of having some definite object in view; rather does she leave one with the feeling that the last perch was not too comfortable and that one more suited to her needs is now being sought.

In the case of the pair of Nuktas with which these notes deal, during the five days the nest remained under observation the drake visited the home tree once daily during the hours of daylight. Always he circled round first, calling loudly, before alighting, high up, but well concealed by the foliage, so that he could not be seen. Not once did he venture near the nest cavity. On one occasion the duck answered the summons—for such it appeared to be—and the pair left the tree together, the drake leading. It was amusing to watch how, when leaving the nest, she disclosed herself very gradually and only emerged when confident the coast was perfectly clear. Then, before flying off, she ascended the tree by stages, following in reverse order the procedure adopted when going to the nest. It was nearly an hour before she re-appeared and a further thirty minutes before she reached the nesting hole. At other times the drake remained on the tree till the late afternoon when finally he left by himself.

By combining business with pleasure I have frequently managed to spend more than the odd day indulging my hobby but I shall always regret that the short leave which I too rarely can avail of has been insufficient to watch for a prolonged period the nesting habits of such an interesting species as the Nukta. Particularly would I have liked to see how the young are initially taken to the water. A *zamindar* friend who said he had once witnessed the event but who was known to be given to exaggerating matters, stated the duck took the young down in her bill, one at a time, to the ground at the foot of the tree, and that when they had been marshalled there, they were led away to the *jhil,* which was only a few yards distant, the drake there joining the family party. Perhaps one day some competent and reliable observer more fortunate than I may be privileged to witness this interesting milestone in the Nukta duckling's life and describe exactly how the young leave their home.

NOTES ON THE ORCHIDS OF MURREE HILL.

BY

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(*With* 9 *plates*).

The plants have been collected from a small area only. This area forms a small part of the uncultivated mountainous wedge of the outer Himalayas. Murree, the most important hill station of Northern India, is situated on top of this wedge. It varies in height from 5,459 ft. (Murree Brewery) to 7,413 ft. (Kashmir Point) above sea-level. The area is two-faced as regards the distribution of vegetation. The eastern face is dry, with scanty undergrowth, and 'Chil' pine (*Pinus longifolia*) as the commonest tree. The western face is dampish, with dense undergrowth, and oaks and the blue pine (*Pinus excelsa*) the commonest trees. Most of the orchids collected from the area grow on the western slopes.

Only nine species of orchids are found in this locality. They are all terrestrial. This small number is perhaps due to the insufficient rainfall during the year (55-60 inches). 38 species of orchids have been described from Simla and its neighbourhood, which area though situated at the same height above sea-level as Murree, gets more rain during the year (85-90 inches).

I take this opportunity of expressing my gratefulness to Mrs. Pushong who illustrated the specimens.

The flower of an orchid. (See Plate VIII).

The flower of an orchid is unlike a common flower in certain respects. It is greatly modified, especially in its essential parts, in order to adapt itself for pollination by insects. In most orchids, the flower is twisted round in such a way that the parts which have developed anteriorly come to lie posteriorly in the open flower. Generally each flower has 3 sepals and 3 petals. In most orchids, one of the petals is of a characteristic shape. It is called the *labellum,* or the lip (*l*). It performs various functions. It serves as a landing place for visiting insects, secretes honey, and in some cases is produced into a long, honey-filled spur. The stamens are confluent with the pistil to form a structure called the *column* (*c*). The stamen is situated on top of the column. It is without a filament. The pollen is not in the form of a loose, dusty powder, but the grains are bound together by means of elastic threads to form masses called *pollinia.* These pollinia are very sticky, but can be removed easily with a needle. The stigma (*st*) lies below the stamen on top of the column. In certain flowers a peculiar structure lies between the stamen and the stigma. This structure is known as the *rostellum* (*r*). According to Darwin it represents a modified stigma. It generally secretes a viscid matter, to which the pollinia adhere very easily, thus they can be reached and easily removed by the visiting insects.

Cephalanthera ensifolia. The Narrow Helleborine Plate I.

This beautiful orchid is locally, but wrongly, known as the 'Lily of the Valley'. The thin creeping rhizome lies deep down in the soil, and bears long, unbranched, thick adventitious roots. The embedded portion of the stem bears colourless, sheathing, scale-like leaves. The green leaves are narrow, simple, alternate, and sheathing. The lower leaves are broader than the upper leaves. The creamy-white flowers are borne on a long, slender spike.

Each flower is bracteate. The sepals are free, with converging tips. The lateral petals are as long as the sepals. The labellum consists of two parts, a cup-like, orange-tinted basal portion embracing the base of the column, and an outer portion with orange-tinted tip, and raised side walls, hinged on to it.

The column is erect, with the stigma on its summit. Rostellum is absent. The stamen stands behind the stigma. Each anther lobe is longitudinally split, and stands like a pillar. The pollen grains are not gathered into pollinia, and are very friable.

The absence of pollinia, and the complete abortion of rostellum in this orchid is, according to Darwin an evidence of its degradation. He looks upon this orchid as a degraded *Epipactis*.

Flowering season:—Middle of April to middle of May.

Liparis rostrata. Plate II.

A very common and delicate orchid, found abundantly on the shady slopes along the West Road. The basal portion of the stem is bulb-like, and bears slender roots. The leaves are broad, and sheathing. The flowers grow on a slender spike.

Each flower is bracteate, the bracts being small. The sepals are broad. The two lateral petals are rolled in on themselves, and hang downwards like threads. The labellum is bi-lobed, slightly tinted, with glandular spots at the base, and supported by lateral sepals. The stamen is in the form of a triangular flap, hinged at the back to the top of the column, which is short, and slightly bent towards the labellum. The stamen lies bent over the stigma at the top of the column. When it is lifted up, the pollinia, yellow and round, are left behind. The stamen is prolonged into a long beak.

The top of the column has a wing-like expansion, which partly conceals the stigma.

Flowering season :—Middle of July to middle of August.

Herminium angustifolium. Plate III.

A very graceful and rare orchid found growing among the undergrowth on shady slopes. There are two root tubers at the base of the stem, and a few unbranched fibrous roots. The stem is slender and hairless, and bears simple, linear, sheathing leaves. The flowers are small and greenish, and crowded on a long, slender spike.

Each flower is bracteate, the bracts being small, linear, and smaller than the ovary. The sepals are small and greenish. The lateral petals are thin, and as long as the sepals. The labellum is adnate to the base of the column. It is bi-fid, with long, divergent side lobes, and a small point in between.

The column is short, and expanded at the top. The two anther lobes are attached to its face. The pollinia are provided with caudicles and glands. The stigma is bi-lobed.

Flowering season:—Middle of July to middle of August.

Habenaria Edgeworthii. Plate IV.

A very common orchid. The stem generally bears one large root tuber, and a few root fibres at the base. The leaves are simple, alternate, and sheathing. The flowers are developed on a long spike.

Each flower is bracteate. The sepals are greenish, with the upper sepal erect, and the two lateral sepals bent downwards. The lateral petals are longer than the sepals, linear, and yellowish. The yellowish labellum is undivided, its basal portion is broad, and the terminal portion narrow, and bent downwards. It is produced into a long spur, which is narrow and slightly curved.

The column is short. The anther lobes are adnate to its face, and separated by a space. Each pollinium bears a caudicle and a sticky gland. The stigma consists of two projecting arms.

Flowering season:—Middle of July to middle of August.

Habenaria intermedia. Plate V.

A rare orchid with large and beautiful flowers, and found on the shady eastern slopes. The base of the stem bears two large tubers, and a few slender roots. The stem is stout, and hairless. The leaves are simple, alternate and sheathing. Only a few flowers are developed on a twisted spike.

Each flower is bracteate. The bracts are leaf-like, the lower being longer and the upper smaller than the ovary.

The sepals are greenish. The upper sepal is broad, with a green centre and thin white bent-in edges. The lateral sepals are out-spreading. The lateral petals are thin, with divergent tips. They stand out in the centre. The labellum is very remarkable. Its basal region is narrow, and produced into a long, greenish-yellow, honey-carrying spur with a slightly enlarged tip. The terminal portion is tri-lobed. The central lobe is linear, and unbranched and as long as the side lobes, which bear along their outer sides long thread-like projections. In most of the flowers examined the labellum and the spur were partly bitten off, probably by insects.

The column is short and stout. The anther lobes are separated by a deep space. Each anther lobe is like a deep, longitudinally split space with projecting sides. The pollen grains are bound together by elastic threads into pollinia. The stigmas are small and rounded, and placed on top of needle-like, closely applied arms in the centre.

Flowering season:—Middle of August to middle of September.

Habenaria Aitchisonia. Plate VI.

This is a very common orchid, found on damp shady slopes. The base of the stem bears two fleshy root tubers and a few unbranched root fibres. The stem is slender and slightly rough. It bears only two prominent leaves that lie flat on the ground. Each leaf is nearly circular, bluish-green in colour, patched with white, and has a short pointed apex. A few bract-like leaves lie above them. The spike bearing flowers is long and slender.

Each flower is bracteate, the bracts being linear, brown-tipped, and smaller than the ovary. The upper sepal is erect, and support the yellowish-green lateral petals. The lateral sepals are outspreading. The labellum is thin, tri-lobed, and produced into a long spur at the base. The lateral lobes are supported on the lateral sepals in freshly opened flowers. The middle lobe is slightly thicker.

The column is short. The anther lobes lie apart, each looking like a longitudinally split space. The pollen grains are united to form pollinia. The stigma is fleshy.

Flowering season:—Middle of August to middle of September.

Epipactis latifolia. Plate VII.

This is a very common orchid. The creeping rhizome bears many unbranched adventitious roots, forming together a compact nest-like structure. The stem is erect, stout, and bears many simple, alternate, sheathing leaves. The flowers are crowded on a long spike.

Each flower is bracteate, and greenish-yellow. The lower bracts are longer and the upper shorter than the ovary.

The sepals are pouched, greenish-yellow, and erect in young flowers, but out-spreading in older flowers. The lateral petals are as long as the sepals. The labellum consists of 2 parts. The basal part is thick, cup-shaped, glandular, and filled with honey in certain flowers. The terminal portion is hinged on to the basal portion, and turned downwards in open flowers. It is like the labellum of *Cephalanthera ensifolia*.

The column is short and stout. The stamen is attached behind to the top of the column. Each anther lobe is longitudinally split, and the pollen masses are visible. The rostellum is well developed, and stands on top of the column. It is covered over by a cap of sticky, soft, and whitish substance. The stigma is broad and projecting.

This orchid, according to Darwin is pollinated by wasps.

Flowering season:—Middle of August to middle of September.

Neottia listeroides. Bird's Nest Orchid. Plate VIII.

This orchid is a total saprophyte, and commonly grows in shady places among dead and decaying vegetable matter along the West Road. It is practically devoid of chlorophyll. The rhizome bears thick, unbranched adventitious roots interwoven to form a compact nest-like structure—hence the name. The older roots sometimes grow into a new plant. The stem is erect, and covered over with stiff, colourless, sheathing scale leaves. The small yellowish flowers are crowded on a long and hairy spike.

Each flower is bracteate, the bracts being smaller than the ovary. The sepals are out-spread in open flowers. The lateral petals are small and linear. The labellum is very conspicuous. It hangs down at an angle. It is flat, greenish along its centre, and bi-lobed at the tip. There is no spur.

The column is long and slightly bent towards the labellum. The stamen is free and protected from behind by a flap-like extension of the top of the column. The pollinia in open flowers rest against the tongue-like rostellum, which partly hides the stigma below.

Flowering season:—Middle of August to middle of September.

Satyrium nepalense. Plate IX.

A rare orchid, found on the sunny slopes above and below the Rifle Range. The stem bears two large and fleshy root tubers, and a few unbranched root fibres. The leaves are large, thick, alternate and sheathing. A few leaf-like bracts lie above them. The flowers are pinkish, scented, and crowded on a long spike.

Each flower is bracteate. The bracts are pink-edged, and turned down in open flowers. The flowers are remarkable in the fact that they are not twisted round like other flowers described before.

The sepals are pink. The upper sepal is recurved, but the lateral sepals are out-spread. The lateral petals are smaller than the sepals, and their tips are turned down. The labellum is posterior in position, hood-like, and adnate to the base of the column. It is produced into two long, slender, downward pointing spurs. Each spur is green-tipped, and longer than the ovary.

The column is short and slender, and a broad, concave stigma is placed at its top. It is produced in front into a beak-like projection immediately below the stigma. Each antherlobe hangs on either side near the base of this projection. The pollinia with their caudicles and the sticky glands are quite visible.

Flowering season:—Middle of August to middle of September.

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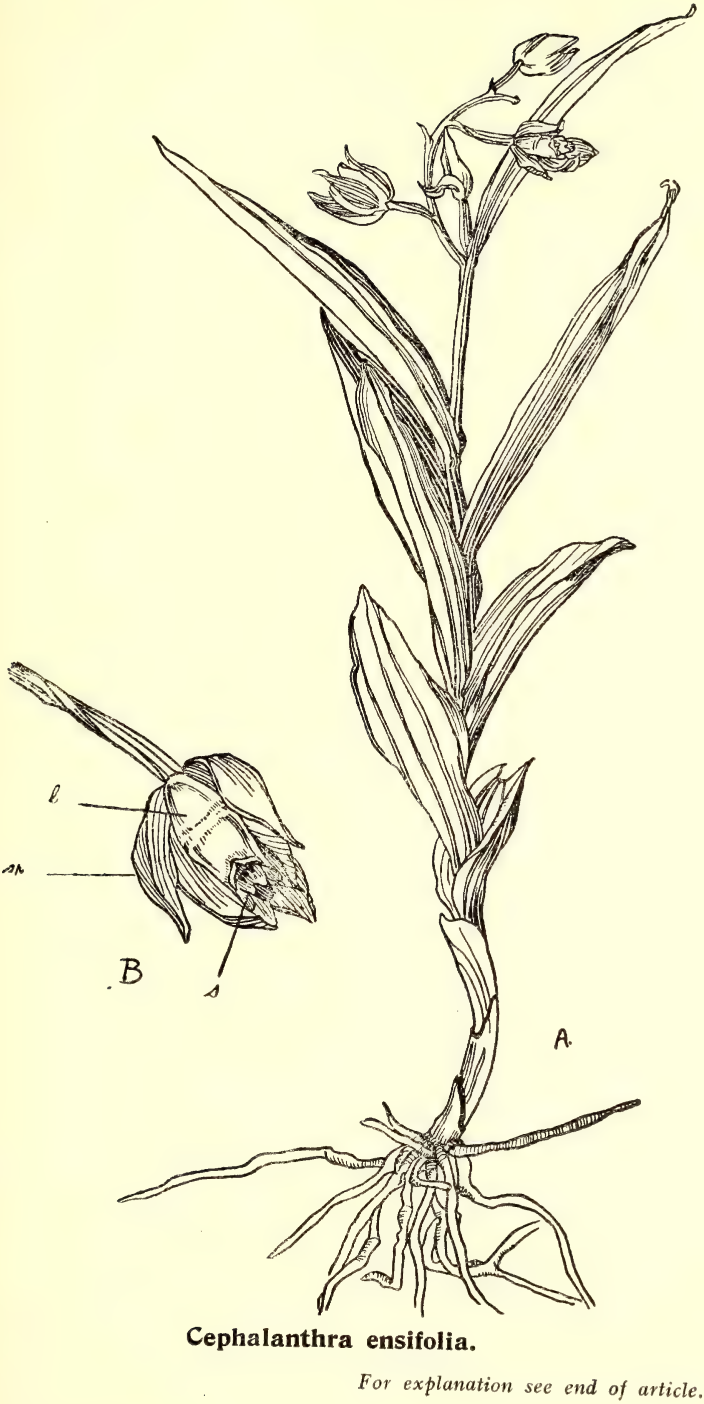
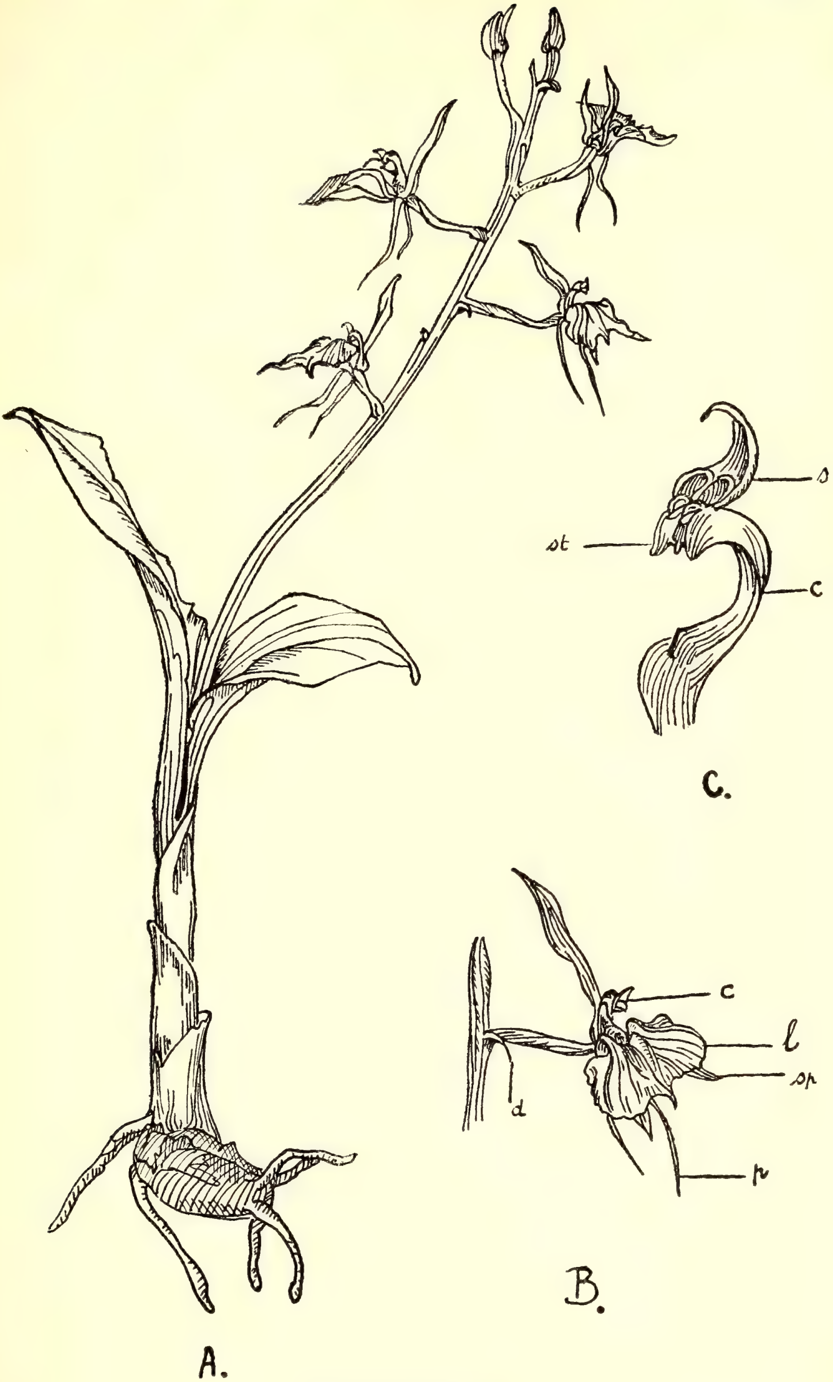


Cephalanthra ensifolia.

For explanation see end of article.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Liparis rostrata.

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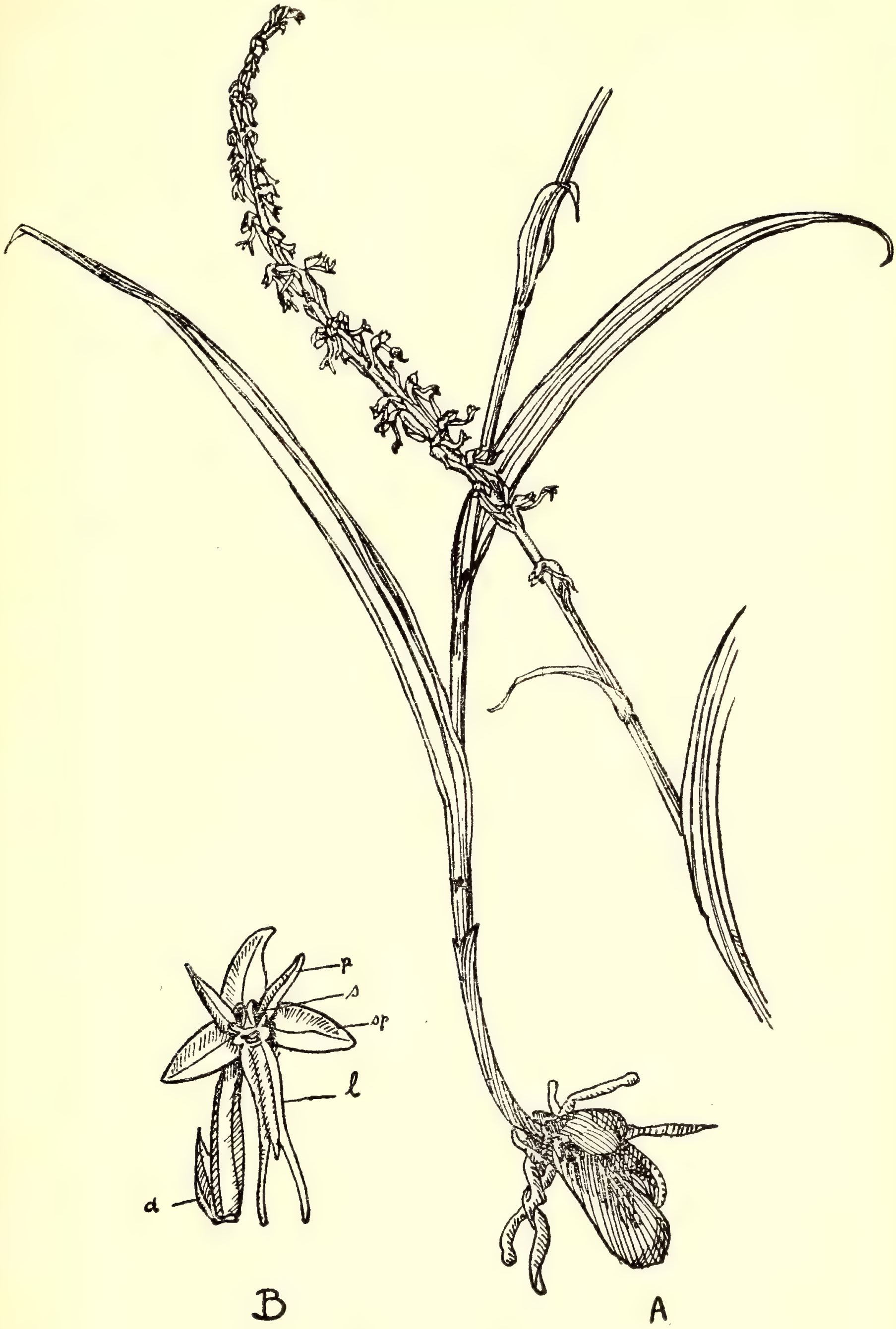

Herminium angustifolium.

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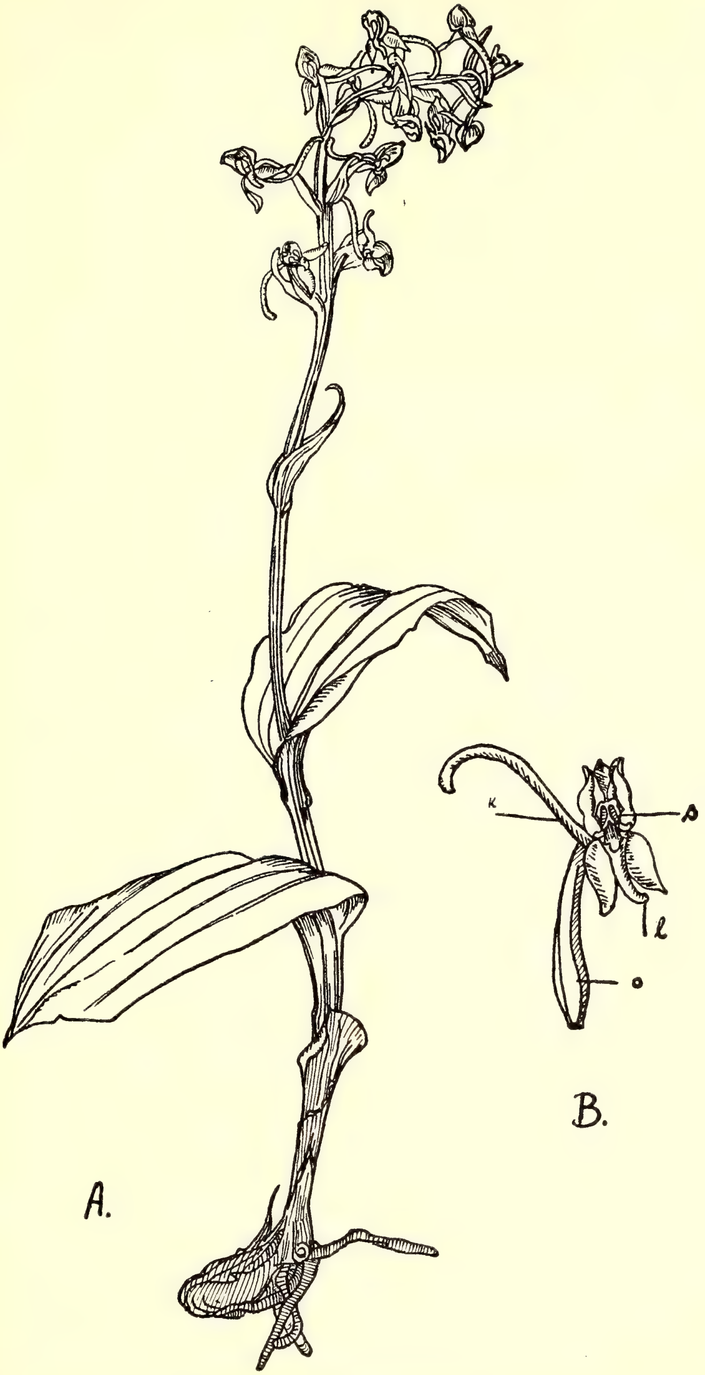

Habenaria Edgeworthii

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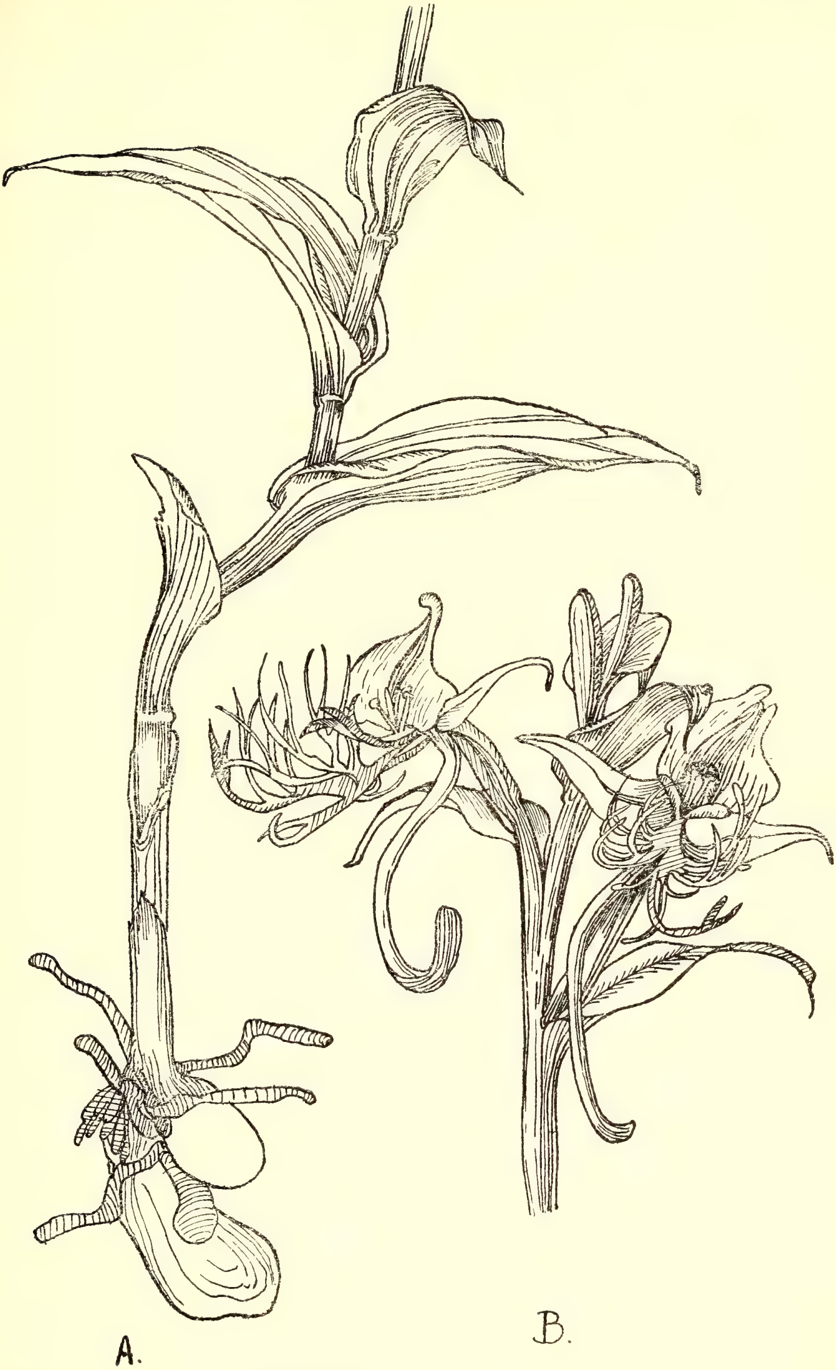

Habenaria intermedia.

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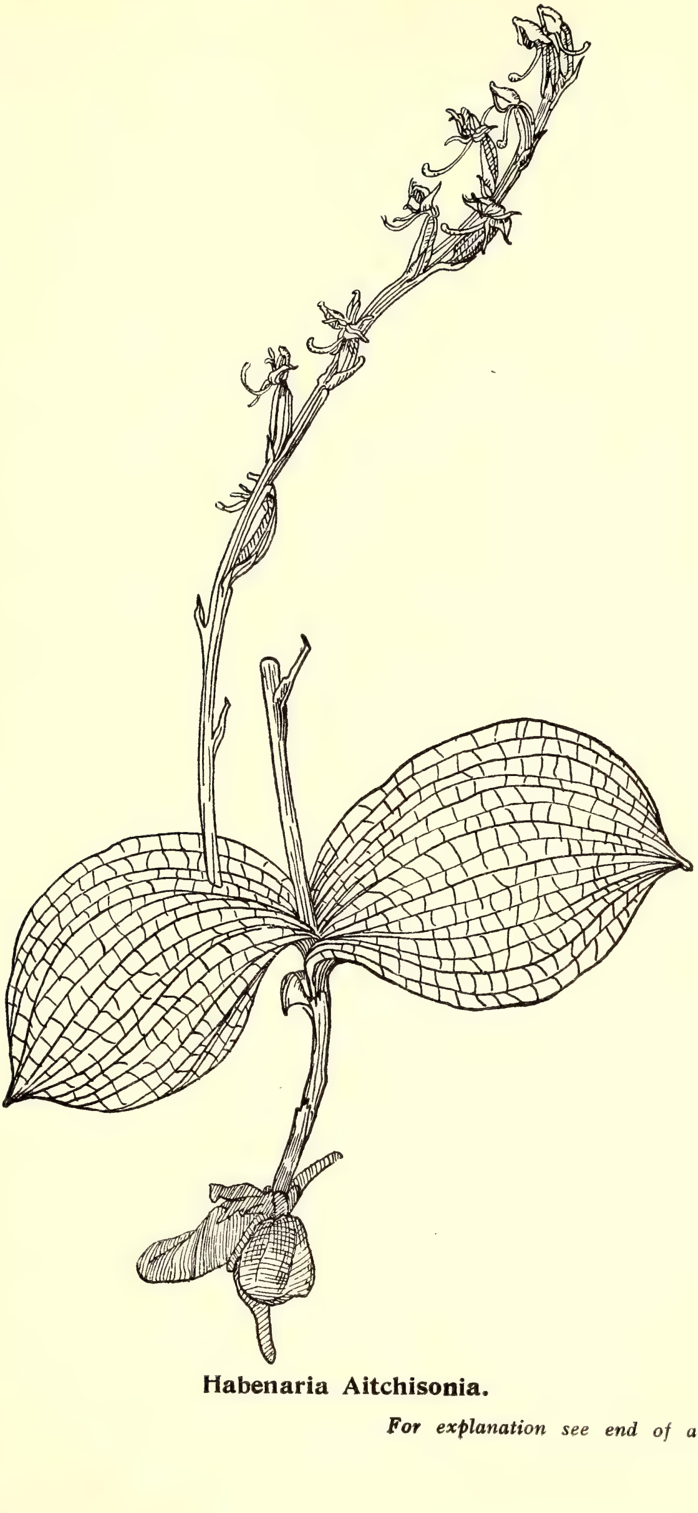

Habenaria Aitchisonia.

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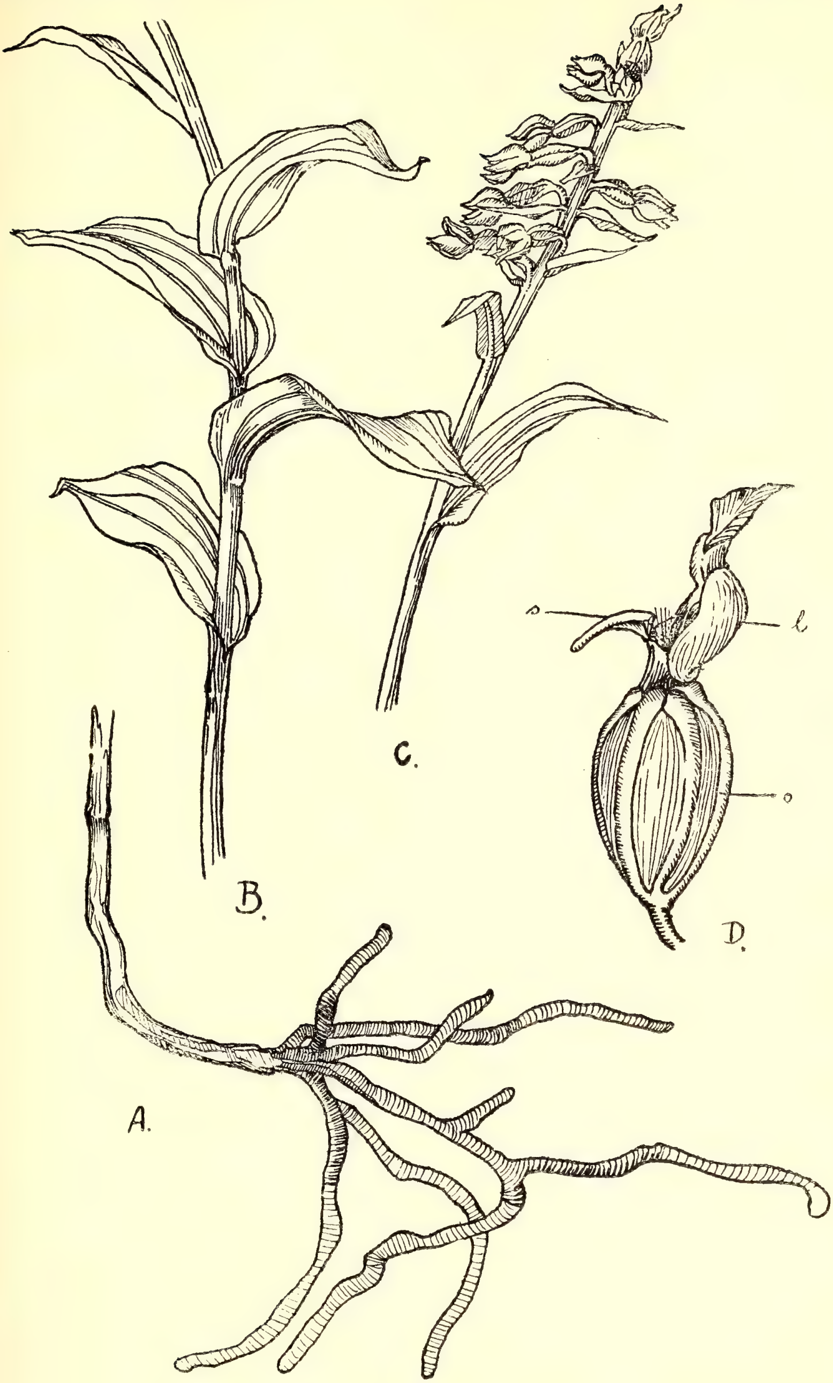

Epipactis latifolia.

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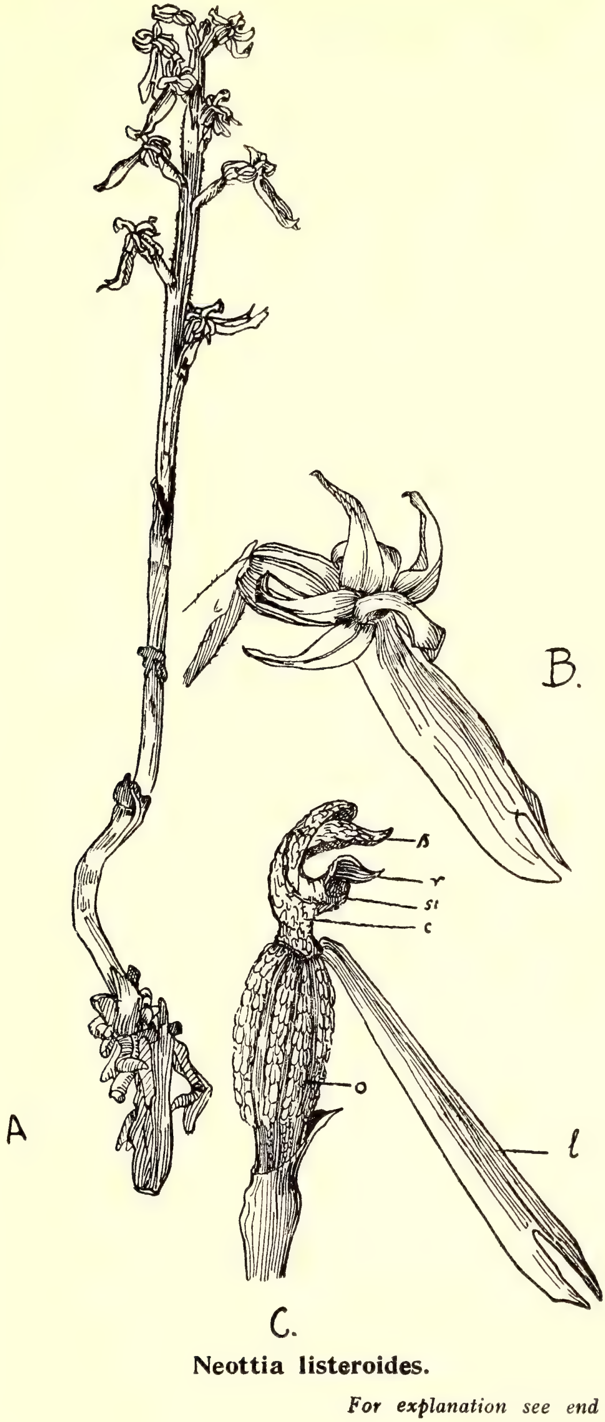
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Neottia listeroides.

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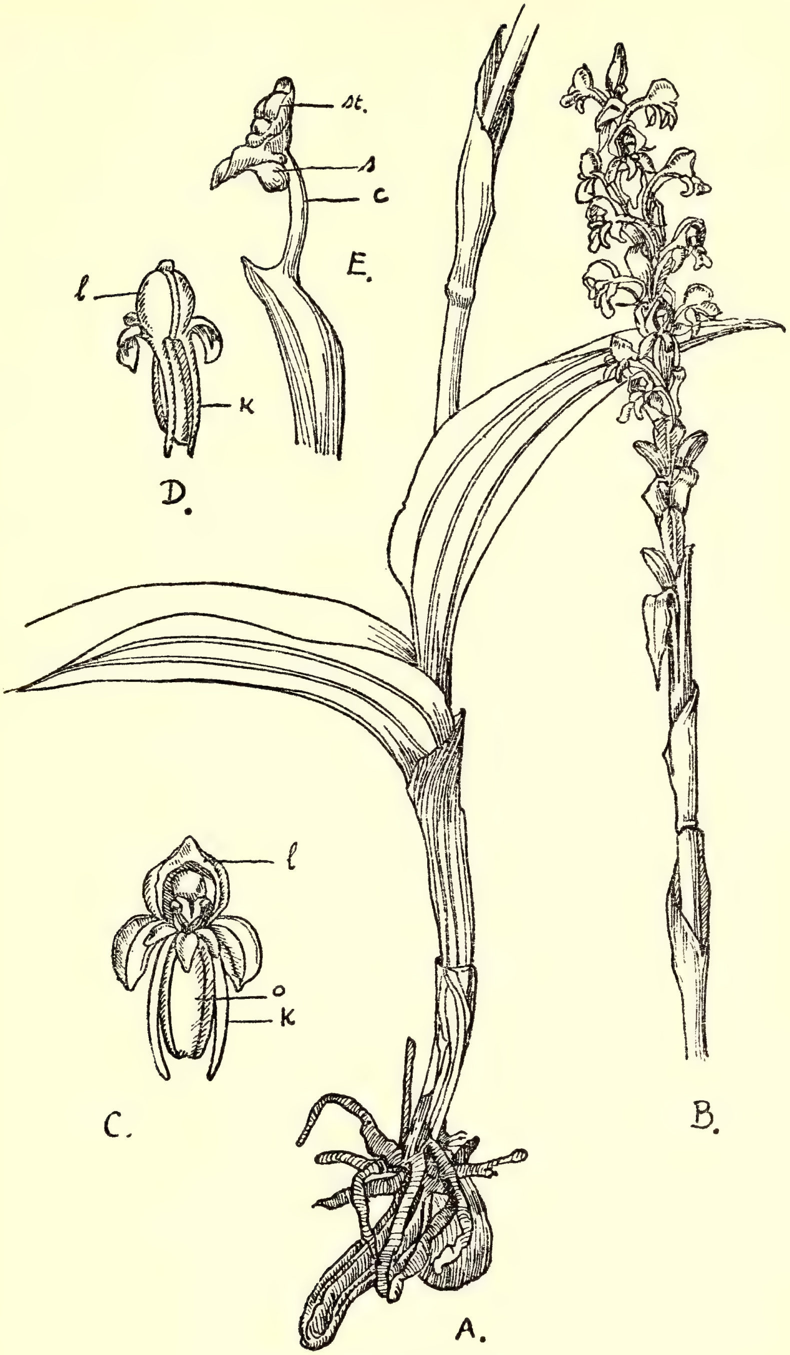
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Satyrium nepalense.

For explanation see end of article.

EXPLANATION OF PLATES.

Plate I. *Cephalanthera ensifolia.*

A. Entire plant.

B. Flower showing labellum (l). Sepals (sp). Stamen (s).

Plate II. *Liparis rostrata.*

A. Entire plant.

B. Flower showing sepals (sp). Petals (p). Labellum (l). Column (c). Bract (d).

Plate III. *Herminium angustifolium.*

A. Entire plant.

B. Flower showing sepals (sp). Petals (p). Labellum (l). Stamen (s). Bract (d).

Plate IV. *Habenaria Edgeworthii.*

A. Entire plant.

B. Flower showing spur (k). Labellum (l). Stamen (s). Ovary (o).

Plate V. *Habenaria intermedia.*

A. Plant showing tuberous roots.

B. Spike bearing flowers.

Plate VI. *Habenaria Aitchisonia.*

Plate VII. *Epipactis latifolia.*

A. Rhizome with adventitious roots.

B. Portion of the stem.

C. Spike.

D. Flower showing labellum (l). Stamen (s). Ovary (o).

Plate VIII. *Neottia listeroides.*

A. Entire plant. B. Single flower. C. Flower showing only ;—

Labellum (l). Column (c). Stamen (s). Stigma (st). Rostellum (r).

Plate IX. *Satyrium nepalense.*

A. Portion of the stem. B. Spike. C. Anterior view of the flower. D. Posterior view of the flower. E. Flower showing only ovary (o). Spur. (k). Labellum (l). Column (c). Stamen (s). Stigma (st).

THE GAME FISHES OF INDIA[1]

BY

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(*With one colour plate, one black and white plate, and five text-figures*).

(*Continued from page* 525 *of Vol.* xli, *No.* 3).

X.—THE MAHSEERS OR THE LARGE-SCALED BARBELS OF INDIA.

3. THE MOSAL MAHSEER, *Barbus* (*Tor*) *mosal* (Hamilton).

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INTRODUCTION.

Though the earlier authors recognised the specific validity of Hamilton's (**5**, p. 306)[2] third large-scaled Barbel, *Cyprinus* (*Cyprinus*) *mosal*, the later workers regarded it only as a synonym of *Barbus tor*. In 1936, Hora and Mukerji (**6**, p. 140) stated that according to Hamilton's descriptions *C. putitora* and *C. mosal* have much in common and, therefore, considered them to be conspecific. In arriving at this conclusion they attached special importance to the form of the dorsal surface in front of the dorsal fin, and to the pale colour of the fins in both the species. In the material before them from the Eastern Doons they regarded the form with enlarged lips as male representing *B. putitora*, and the form with ordinary lips as female representing *B. mosal*. In an earlier article I (**8**, pp. 279-282) have surmised that the enlargement of lips is probably not a sexual character but may prove to be an adaptative feature induced by life in swift currents. As is well known Hamil-

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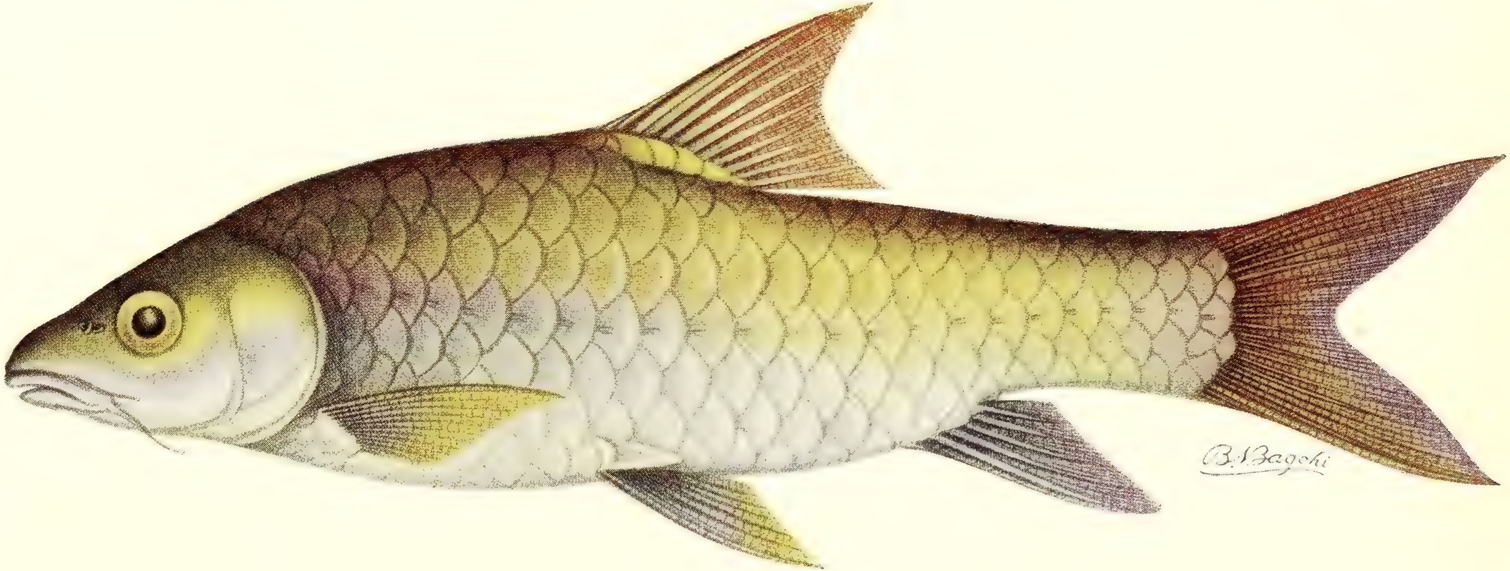
[1] Published with permission of Director, Zoological Survey of India.

[2] Numerals in thick type within brackets refer to the serial numbers of the various publications listed at the end of the paper.



The Mosal Mahseer, BARBUS (TOR) MOSAL (Hamilton).

ton's descriptions are more or less generalized, but in his notes on the fish and fisheries of Bengal (*vide* Day **3**, p. 65) he compared *Mosal* with *Tor* and observed that

> 'The *Măsăl* of the Kusí is a very large fish, which many people think still better than the Rohu, and compare to the salmon. I cannot say that I could perceive any resemblance. It does not grow to such an immense size as the Mahắsaul of the Brahmaputra, but has very large scales, and has a great affinity to that fish, and still more to the one last mentioned.' (Tŭrĭyắ or Săhărắ of the Kosi R.).

From the above statement it is clear that Hamilton's *mosal* is more closely allied to his *tor* than to his *putitora.* Though in his brief characterization of the species Hamilton (**5**, p. 388) says 'pinnis pallidis', his full description shows that 'The fins have no spots, and a slight orange tinge.' The Mosal was found in the river Kosi where it is said to grow to four or five feet in length. It is stated to be 'of a long, compressed, but thick *form,* more prominent on the back than on the belly; its *colours* shining above with green and gold, and below with silver'. According to Hamilton, 'The *head* is sharp, oval, and narrower than the body, and smooth, with a small tubercle between the nostrils, as in the last species [*Cyprinus tor*] but less strongly marked.'

Fortunately Hamilton made a drawing of his *Cyprinus mosal* which was reproduced by Gray (**4**, I, pl. xciii, fig. 1) in his 'Illustrations of Indian Zoology' without any acknowledgment or letterpress. Some of the salient features of the fish can be made out from this illustration, which is reproduced here on plate ii. The head is sharpish and the body is almost as deep as the length of the head. The lips are not enlarged, and the eye is situated wholly in the anterior half of the head. The dorsal spine is strong and bony; it is almost as long as the head without the snout. The tail narrows gradually towards the posterior end.

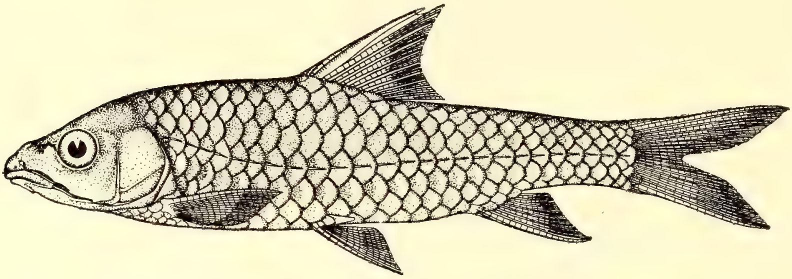
SYNONYMY AND DESCRIPTION.

Barbus (Tor) mosal (Hamilton)

1822. *Cyprinus* (*Cyprinus*) *mosal,* Hamilton, *Fish. Ganges,* pp. 306, 388.
1832. *Cyprinus mosal,* Gray, *Ill. Ind. Zool.,* I, pl. xciii, fig. 1.
1839. *Barbus megalepis,* McClelland, *As. Res.,* XIX, pp. 271, 337.
1877. *Barbus hexastichus,* Day, *Fish. India,* p. 565, pl. cxxxvi, fig. 4.
1889. *Barbus hexastichus,* Day, *Fauna Brit. India,* I, p. 308.
1889. *Barbus hexastichus,* Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova,* IX (2), p. 291.
1929. *Barbus hexastichus,* Prashad & Mukherji, *Rec. Ind. Mus.,* XXXI, p. 200, text-fig. 7.
1934. *Barbus tor,* Mukerji (in part), *Journ. Bombay Nat. Hist. Soc.,* XXXVII, p. 63.

In characterizing *Barbus mosal* I have relied mainly on the description and figure of the species by Hamilton (**5**); features that distinguish it from *B. putitora* and *B. tor* are given above in the introduction. In this species the depth of the body is more or less equal to the length of the head (considerably greater in *B. tor* and considerably less in *B. putitora*); the dorsal profile is more elevated than the ventral, the head is sharpish in front and the dorsal spine is very strong. In the collection of the Indian Museum, *B. mosal* is represented by a few specimens and even these are mostly from Burma. The species may be described as follows :—

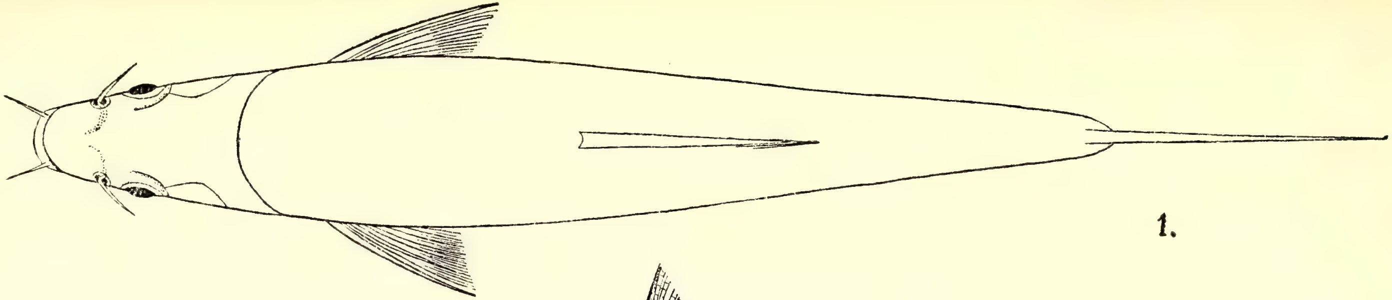
D. 4/8-9; A. 3/5; P. 17; V. 8-9; C. 19+.



Text-fig. 1.—Lateral view of a specimen of Mosal Mahseer, ***Barbus*** (*Tor*) *mosal* (Hamilton) from Upper Chindwin, Burma, in the collection of the American Museum of Natural History. x ½.

The Mosal Mahseer (text-fig. 1) is a graceful fish in which the dorsal profile is more prominently arched than the ventral. The head is of moderate size and more or less pointed anteriorly. The length of the head is contained from 3·5 to 4·0 times in the standard length; the height of the head at the occiput is considerably greater than its width. Though in Hamilton's figure the eyes are shown in the anterior half of the head, in the specimens examined by me the eyes are only slightly nearer the tip of the snout than to the posterior margin of the operculum; the diameter of the eye is contained about 3·3 times in the length of the head in smaller individuals and 4·2 times in medium-sized specimens. In Hamilton's drawing the eye is contained 7 times in head, but it has to be remembered that Hamilton may have made his sketch from a specimen 'four to five feet long'. As has been indicated in an earlier note on the Silond Catfish (7, p. 144) the proportions vary considerably with the growth of the fish. In young specimens the snout is almost equal to the diameter of the eye, but with growth it becomes considerably longer than the eye. Similarly the interorbital width in relation to the diameter of the eye increases considerably with the growth of the fish. The depth of the body is more or less equal to the length of the head and is contained from 3·3 to 4·0 times in the standard length. The least height of the caudal peduncle is contained from 1·4 to 1·6 times in its length.

The mouth is of moderate width; its gape does not extend to below the eyes and is somewhat obliquely directed upwards. The lips are fleshy and continuous at the angles of the mouth. In the specimens examined by me the posterior lip is produced into a median lobe, the extent of which varies considerably; the post-labial groove is continuous. With regard to the enlargement of the lips observations have already been made in the two earlier articles on the Putitor and the Tor Mahseers. In Mosal Mahseer



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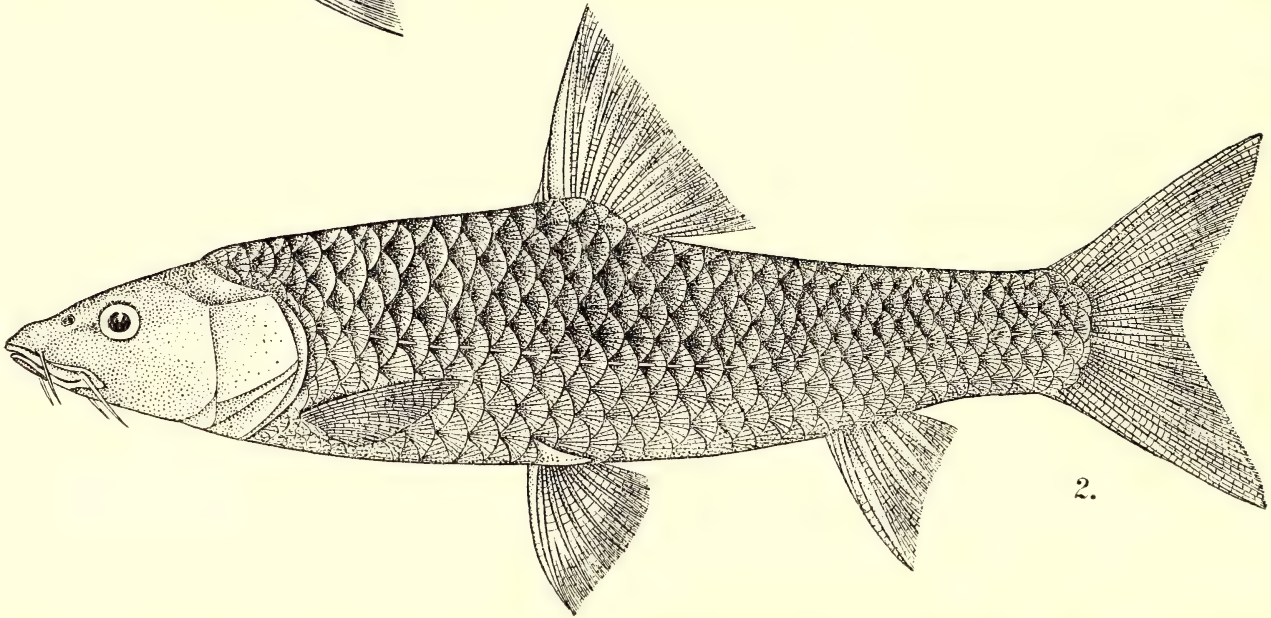
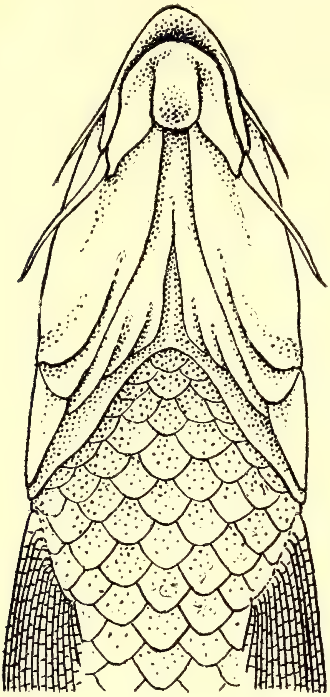


2.

Copies of Hamilton's original drawings of *Cyprinus* (*cyprinus*) *mosal.*

Fig. 1.—Outline of dorsal view. Fig. 2.—Lateral view.

also, the lips may be plain as shown in Hamilton's figure of the species (plate ii) or hypertrophied as is the case in the specimens



Text-fig. 2.—Ventral surface of head and anterior part of body of the specimen of Mosal Mahseer, *Barbus* (*Tor*) *mosal* (Hamilton), collected by Mr. D. E. B. Manning from the Mintha Stream, Tavoy District, Burma. Nat. size.

before me (text-fig. 2). With regard to the various forms of Mahseer based on this character Beavan (**1**, p. 43) observed that

> 'These fish vary so much, however, with regard to the apparent shape of their heads and the thickness of their lips, according to their age, the kind of stream they are living in, and the season of the year, that I think it safer at present to leave them under one name, although they may possibly turn out eventually to belong to two or more distinct species. I have found generally that those which are found in still water, or such as have been feeding chiefly on water weeds, and the larger specimens, have soft thick lips, more or less lobed, of which the upper has a tendency to project over the lower one, and to make it out, the only reliable point seems to be the comparative length of the head.'

These observations, though they do not bear out my contention that the enlargement of the lips is a character which may be induced for purposes of adhesion in individuals living in swift currents, show that the hypertrophy of the lips is not a sexual character but may be produced through the operation of environmental factors, such as food, nature of stream, etc. As indicated in an earlier article (8, p. 282) it is desirable that to elucidate this point anglers should make comprehensive observations on the nature of the streams and the Mahseers caught therefrom.

The maxillary barbels are longer than the rostral barbels and are somewhat shorter or longer than the diameter of the eye. The scales are large, there being 23 to 26 scales along the lateral line and 2½ rows between it and the base of the pelvic fin. The general lepidosis is similar to that described for the other two kinds of Mahseer. There is a well-developed scaly appendage in the axil of each pelvic fin.

The dorsal fin commences opposite to or slightly in advance of the pelvics; it commences midway between the tip of the snout and the base of the caudal fin, but this character may vary with the size of the specimen. The last dorsal spine is very strong and bony, and though it is generally less than the depth of the body below it, in young specimens it may be equal to it. The pectoral fins are low, pointed at the top and considerably shorter than the length of the head. The pelvic fins are also sharp and do not extend to the anal fin. The caudal fin is deeply forked with both the lobes pointed.

The colouration of the species varies considerably with the type of waters inhabited by it. Hamilton (**5**, p. 306) noted that its colours are 'shining above with green and gold, and below with silver. The fins have no spots, and a slight orange tinge. The eyes are silvery, dotted above.' In sending me a specimen and colour sketch of *B. mosal* collected in the Mintha Stream, Tavoy District, Burma, Mr. D. E. B. Manning observed that 'The fish is very much duller than the true Mahseer and is more yellow than gold in appearance.' With his kind permission I am reproducing his sketch as the colour plate for this article. It will be noticed that in the Tavoy example the dorsal surface of the head and the anterior part of the body is olivaceous yellow which is replaced posteriorly by a burnt amber colour. A small portion of the body behind the head is purplish yellow, while above the lateral line it is Indian yellow, and below bluish silvery white. In front of the caudal fin the tail is vinaceous pink; the fin itself is orangish yellow with a border of purplish yellow. The dorsal fin is light reddish orange with neutral tint at its basal part. The basal parts of the pectoral and pelvic fins have a neutral tint while the distal portions are light orange yellow. The anal fin is reddish neutral. Below the eyes the head is yellow with shades of silver blue and pink.

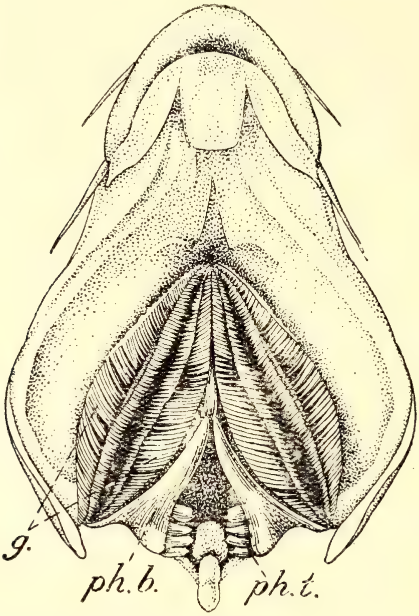
Bionomics and Distribution.—No specific observations on the bionomics of *B. mosal* are available. Mr. Manning in his notes remarked that 'This fish is not common, but generally frequents mahseer streams where it is said to be mainly leaf eating. I took this specimen on a 2″ spoon in the Mintha Stream in the Mintha Reserve.' The Burmese name for it is *Mgayan-weh* and according to Mr. Manning it is possibly the Yellow Mahseer. From the specimens examined by me, *B. mosal* appears to be more common in Burma than in the Himalayan streams.

MEASUREMENTS IN MILLIMETRES AND SCALE COUNTS

—	Monghyr	Assam	Lonkin, Upper Burma	Phungin Hka, Upper Burma		Kamaing, Upper Burma		Tavoy, Lower Burma
Total length	271·0	267·0	201·0	...	180·0	420·0	395·0	...
Standard length	215·0	213·0	159·0	188·0	142·0	350·0	320·0	250·0
Length of head	62·5	53·5	40·0	50·0	38·0	87·0	82·0	66·0
Height of head	40·5	38·5	29·0	36·0	26·0	70·0	62·0	46·5
Width of head	35·0	30·5	23·5	30·0	20·0	53·5	54·0	41·0
Diameter of eye	15·0	14·5	12·0	14·0	11·5	21·0	20·5	19·0
Length of snout	18·5	17·0	13·0	16·5	12·0	31·0	28·0	23·0
Interorbital distance ...	20·0	19·0	14·0	19·0	13·0	37·0	34·0	26·0
Depth of body	62·5	59·0	39·0	50·0	36·0	97·0	85·0	77·0
Width of body	36·0	32·5	23·0	29·0	18·0	55·5	49·0	39·5
Length of caudal peduncle ...	36·0	37·5	25·5	31·3	24·0	60·0	52·0	45·5
Least height of caudal peduncle	25·5	25·5	16·5	22·5	15·5	44·0	38·0	31·5
Length of dorsal fin ...	48·0	47·0	40·0	50·0	31·0	75·5	D	54·0
Length of pectoral fin ...	48·0	38·5	30·0	39·2	27·0	73·0	69·0	53·5
Length of pelvic fin ...	38·0	32·0	26·5	34·5	21·3	52·0	D	49·0
Length of anal fin ...	39·0	35·5	28·5	35·5	21·3	51·0	D	52·0
Length of rostral barbel ...	13·0	11·0	8·0	10·5	9·5	22·0	22·0	17·0
Length of maxillary barbel	17·0	12·5	12·0	13·5	10·5	25·0	30·0	25·0
Scales along lateral line ...	25	24	25	24	26	26	25	23
Scales between lateral line and v.	2½	2½	2½	2½	2½	2½	2½	2½

MODE OF FEEDING AND THE RÔLE OF THE PHARYNGEAL TEETH.

Like all Cyprinoid fishes, the Mahseers are devoid of any teeth in the jaws, but this loss is compensated by the remarkable development of the fifth branchial arch, the pharyngeal teeth and the pharyngeal muscles. These teeth lie in the throat of the fish (text-fig. 3) and, in consequence, are not used in catching or holding the prey, but are employed for tearing and masticating purposes. In Cyprinoid fishes, as a rule, the upper jaw is protrusible and, as these fishes are mostly bottom-feeders the upper lip, in apposition with the lower, forms a sucking cup. I have noticed that when the young of Catla [*Catla catla* (Ham.)], Rohu [*Labeo rohita* (Ham.)] and Mirgal [*Cirrhina mrigala* (Ham.)] were introduced in a filter bed of the Calcutta Corporation Waterworks at Pulta the surface of the bed became covered with small regular pits owing to the bottom-feeding habit and the suctorial action of the mouth. The sucking action of the mouth in the case of Mahseer is discussed in detail by Thomas (**9**, pp. 45, 46) who made the following test to verify this action:—



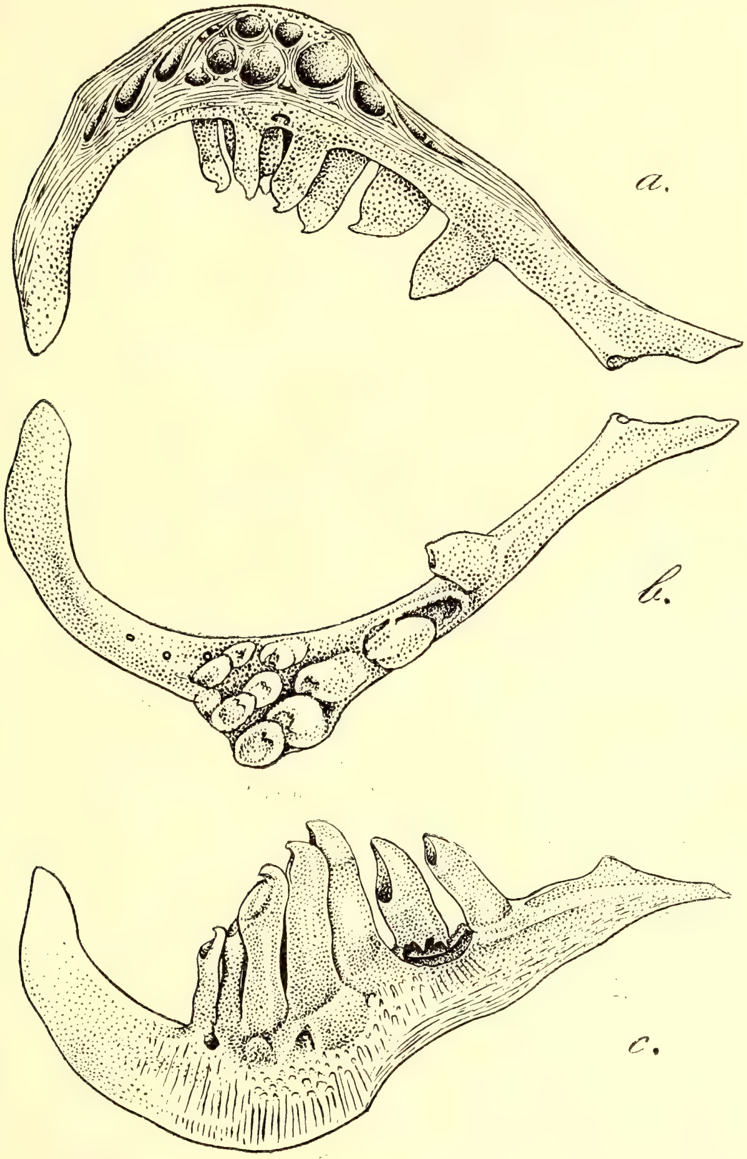
Text-fig. 3.—Ventral view of the branchial arches and a portion of the hyoid arch of Putitor Mahseer, *Barbus* (*Tor*) *putitora* (Hamilton). x $1\frac{1}{3}$.

g. Gills; *ph.b.* Pharyngeal bone; *ph.t.* Pharyngeal teeth.

Notice the position of the pharyngeal bones and their teeth in the throat of the fish just behind the four gill-bearing arches. The teeth can be readily exposed by making an incision along the mid-ventral line of the head.

> 'To test their power of sucking up, I have fed them at a place where they were accustomed to be fed, and tempted them nearer and nearer, till they were well within observation, and having then thrown in a good handful of rice,

so that much of it must sink to the bottom before they could get it, I watched them taking it off the sandy bottom. They sucked it up with great rapidity, so that it wanted close observation, but I watched them very carefully for



Text-fig. 4.—Left pharyngeal bone and teeth of Putitor Mahseer, *Barbus* (*Tor*) *putitora* (Hamilton). x 3.

a. Dorso-lateral view, showing the pitted surface; *b.* Lateral view, showing arrangement of teeth in three rows—5, 3, 2; *c.* Ventro-lateral view, showing the decaying basal portion of the second tooth of the outer row.

The teeth are curved near their extremity and are hooked and pointed. The length of head of the specimen is 110 mm.

> some time, and distinctly saw the upper lip thrust out from its socket, and brought down over the rice, and then there was a clear act of suction for each grain, though the grains were taken up one after another nearly as fast as a fowl picks up corn. The fish the while were not swimming level in the water, but with their tails just enough inclined upwards to allow the pectoral fins to work without touching the bottom. The pectoral fins were so near the bottom that the motion contributed to the water by each vibration stirred up the fine sand, but they did not touch the bottom. By the suction from the mouth, however, I could not perceive that any sand at all was disturbed. They picked up the single grains of rice cleanly and cleverly, and quickly.'

According to Thomas, this type of sucking mouth enables the fish to feed at various depths at pleasure, and this is corroborated by the fact that Mahseers can suck floating objects as easily as the organisms lying at the bottom. Moreover the power of compression exercised by the lips and jaws is so great that small fish etc. are instantly killed.

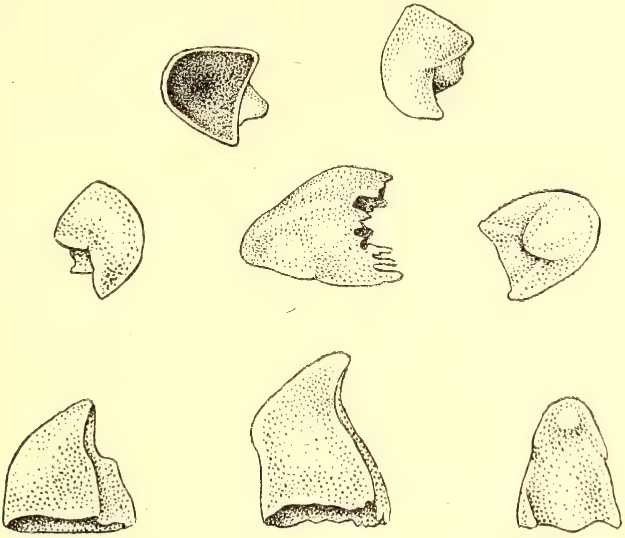
Anglers in India often preserve the pharyngeal teeth (text-fig. 4) of Mahseers as trophies, especially as they provide a fairly reliable evidence of the size of the specimen to which they belonged. In the circumstances the sportsmen are naturally interested in some knowledge of the growth, form and function of these teeth. So far reliance has been placed on the account given by Thomas (**9**, p. 47), but recent enquiries made through the Bombay Natural History Society show that more up-to-date and detailed information is now sought. Thomas stated:

> 'These pharyngeal or throat teeth are not set in sockets like human teeth, but are continuations of the pharyngeal bones. Unlike other teeth in fish instead of dentine, they have a coating of enamel, which is continued to their base. There seems to be no provision for renewing them in case of loss, no adjoining row of teeth as in the shark, no second tooth below as in the human being; and in an instance in which I noticed that two were wanting on one side, the place where they should be was quite smooth. They are not used for capturing food at all, but for crushing it in its passage down the throat. The fine perforations through which they are supplied with nerves and nutriment are easily seen. The attachment of the muscles to the pharyngeal bones is also very apparent and in keeping with what we know of the power with which they are used.'

Though in general Thomas's statement about the pharyngeal teeth is quite sound, the views about their development and replacement are not correct. It is now known that in Carps of various kinds the teeth are developed from the mucous membranes overlying the inner lateral surfaces of the pharyngeals and later become ankylosed to the bony processes of the pharyngeals. 'They are shed from time to time and new ones coming in from the side succeed them throughout life.' (**2**, p. 95). In making preparations of the pharyngeal teeth, sometimes, besides the functional teeth which are attached to the pharyngeals, other teeth (text-fig. 5) in various stages of development may be observed freely embedded in the mucous membrane and destined to replace the old teeth when they are lost. It has also to be borne in mind that 'Although the teeth of Cyprinids are so intimately incorporated with the pharyngeals that they appear as a part of the bone, they are of different morphology and origin. The pharyngeals are cartilage bones entirely of mesodermal origin, while the teeth have a double origin—

the enamel from the ectoderm; the dentine, pulp and cement from the mesoderm and arise independently of the pharyngeals.' (2, p. 95).

The fact that most of the anglers, when macerating[1] the teeth, are liable to throw away the young growing teeth with the muscles and membranes has probably led to the belief that the teeth, once shed, are not replaced.



Text-fig. 5.—Young teeth of the Putitor Mahseer, *Barbus* (*Tor*) *putitora* (Hamilton), in various positions and stages of development removed from the mucous membrane of the teeth. x 10.

In Mahseers there are 10 teeth on each pharyngeal bone arranged in three rows of 5, 3 and 2 teeth (text-fig. 4 *b*) respectively. It has been observed that up to about 7 lbs. weight the teeth are hooked and pointed (text-fig. 4), but from 9 lbs. upwards they show signs of wear and are invariably flattened and smooth on their tops. This wear and flattening becomes more and more marked as the fish grows older. The form of the teeth is generally correlated with the nature of the food and it is well-known that whereas in the younger stages Mahseer feed on algae, insects, small fish, etc., middle-sized specimens and older ones take to feeding on crabs, molluscs and other hard objects for which powerful crushing and grinding teeth are required. In this connection it may be recalled that larger Mahseers, over 30 lbs. in weight, are chiefly taken by bottom fishing with Regi paste and are generally difficult to take on a spinner of any sort. Probably all teeth are not shed at the same time, and in my preparations of the pharyngeals of Putitor Mahseer, weighing 4 to

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[1] If the pharyngeal bones are left for a shorter or longer time in a weak solution of caustic potash, the period depending on the strength and quantity of the solution used, the muscles and membranes are dissolved and a good preparation of the pharyngeal bone with the attached teeth results. The young growing teeth and the cast off teeth, if any, can also be collected from the bottom of the vessel.

6 lbs., I found the basal parts of one or two outer teeth worn out (text-fig. 4 *c*) and the teeth about to drop off. In the tissues in between the teeth apical portions of about 3 developing teeth in each set were found in different stages of development (text-fig. 5). Whatever may be the case with the European Carp, *Cyprinus carpio* (Linnaeus), which is believed to shed its teeth annually before spawning time, in the case of Mahseer there is presumptive evidence from the observations made by anglers in various parts of India that the whole set of teeth is not shed at one time. The teeth are shed individually as they become worn out and replaced by the fresh teeth that may be found growing in the adjoining mucous membrane.

ACKNOWLEDGMENTS.

The Bombay Natural History Society has very generously borne the entire cost of illustrating this article and for this my best thanks are due to the authorities of the Society. I am indebted to Mr. K. S. Misra for preparing the table of measurements. I am obliged to Mr. D. E. B. Manning, Divisional Forest Officer, Burma, for sending me a specimen and a colour sketch of the Yellow Mahseer from the Tavoy District. The illustrations were prepared under my supervision by Babu B. Bagchi with his usual skill and care.

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EXPLANATION OF PLATES.

Explanation of Plate I.

Colour Sketch of a Mosal Mahseer, *Barbus* (*Tor*) *mosal* (Hamilton).

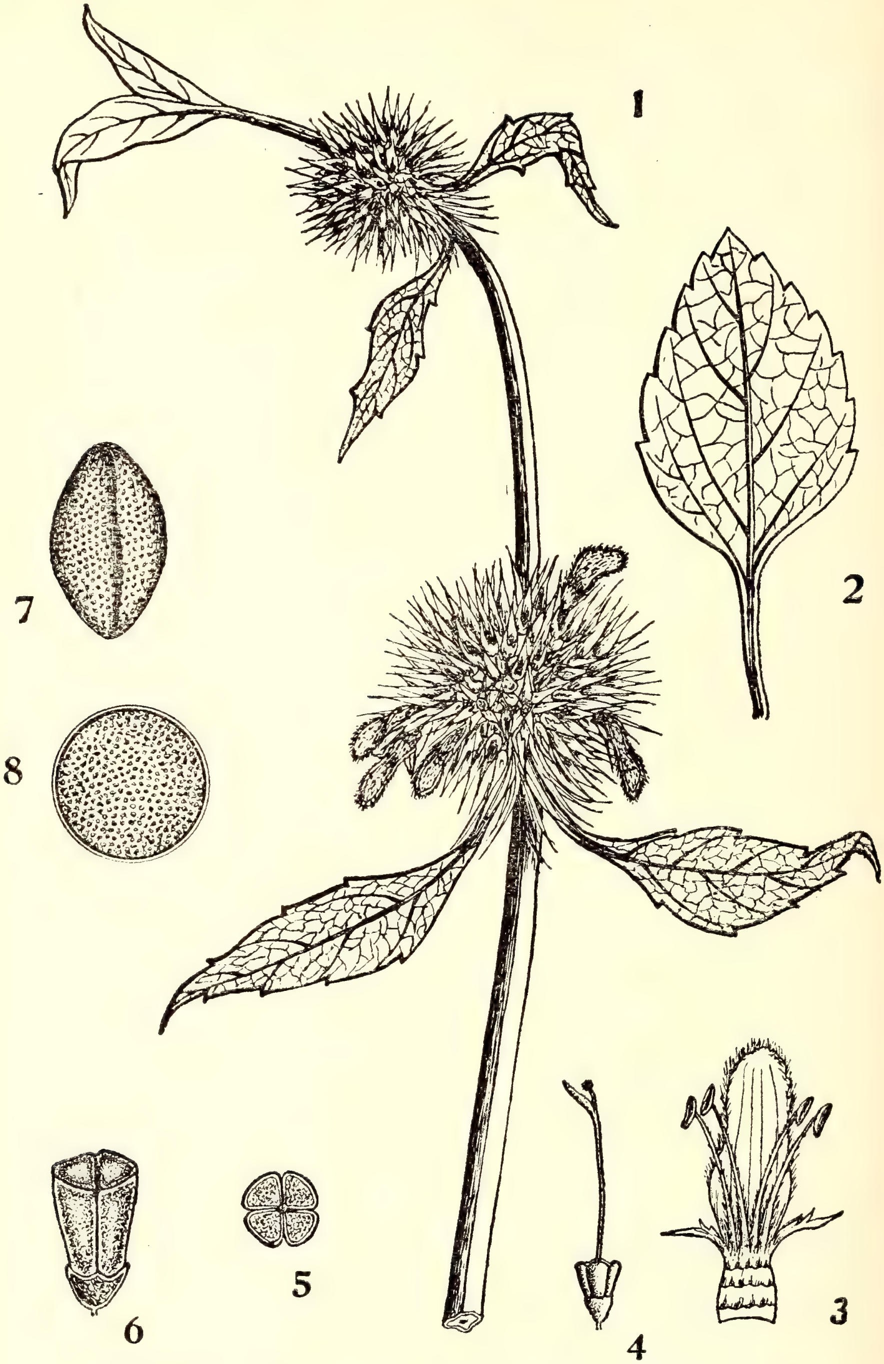
The specimen was collected by Mr. D. E. B. Manning, Divisional Forest Officer, Burma, from the Mintha Stream in the Tavoy District. He also made a rough colour sketch when the specimen was still fresh.

Explanation of Plate II.

Copies of Hamilton's original drawings of *Cyprinus* (*Cyprinus*) *mosal* (MS drawing No. 122, vol. iv, A. S. B. Library).

Fig. 1.—Outline sketch of dorsal view.

Fig. 2.—Lateral view.



Sayeedud-Din—Common Indian Herbs: *Leonotis nepetaefolia* R. Br.
For explanation see end of article.

SOME COMMON INDIAN HERBS WITH NOTES ON THEIR ANATOMICAL CHARACTERS.

BY

M. SAYEEDUD-DIN,

Prof. of Botany, Osmania University, Hyderabad Deccan.

(With three plates).

(Continued from page 550 *of Vol.* xli, *No.* 3).

IV.—LEONOTIS NEPETAEFOLIA R. Br.

(LABIATÆ).

SYNONYMY AND SYSTEMATIC DESCRIPTION.

Leonotis nepetaefolia R. Br. Prodr. 504; H. F. B. I., IV, 691; Cooke. Fl. Bomb. Pres., V. II, Pt. III, 471; Benth. in DC. Prodr. XII, 211; Grah. Cat., 153; Dalz. & Gibs. Bomb. Fl., 211 & Suppl., 67; Wight. Icon. t., 867; Trim. Fl. Ceyl., V. 3, 387; Prain. Beng. Pl., 857; Watt. Dict. Econ. Prod. 1., V. 4, 625. Syn:—*Phlomis nepetaefolia* Linn.; Roxb. Fl. Ind., III, 8. *Leonurus globosus* Moench Meth. 400.

A tall erect herb, 4-6 ft. high; stem stout, quadrangular with thickened angles, deeply furrowed, finely pubescent. Leaves membranous, ovate, acute, coarsely crenate-serrate, finely pubescent on both sides, base shortly cuneate, running down into the petiole; petiole winged in the upper part; leaves in the floral region lanceolate, deflexed. Flowers in axillary globose many-flowered distant whorls; bracts linear, deflexed, spinous-pointed, pubescent. Calyx $\frac{3}{4}$ in. long, ribbed, tubular, incurved, pubescent or villous, teeth spinescent; throat glabrous. Corolla 1 in. long, orange-scarlet; tube (my observations tally with Cooke's in that the corolla-tube is not exserted) densely clothed in the upper part with orange-scarlet hairs, annulate inside with 3 transverse parallel rings of white hairs; upper lip $\frac{1}{2}$ in. long, densely wooly with orange-scarlet hairs; lower lip 5 in. long, deeply 3-lobed. Stamens 4, didynamous; anthers conniving, cells divaricate. Pollen grains ellipsoidal when dry, and spherical when moistened. Disc equal. Style subulate, upper lobe very short. Fruit of 4 oblong-obovoid, angular, obliquely truncate, glabrous nutlets with a deep triangular pit at the apex. (Plates I & II). Flowers: Sept.-Dec. Medicinal (Kirtikar, 4).

INDIAN NAMES.

Hejur-chei (Hind); Dipmal, Ekri (Mar.); Rana Cheri, beri, hanumanta bira (Tel.).

HABITAT.

Throughout hotter India, not very common, cultivated and naturalized, doubtfully indigenous (Hooker, 2). Pretty common in the Deccan (Cooke, 1), commonly found in Hyderabad (Sayeedud-Din, 7); found in waste places in Madras (Mayuranathan, 5). Distrib. Ceylon, Tropical Asia, Africa and America.

ANATOMICAL NOTES.

Structure of the leaf. (Plate III, Figs. 1-4). The leaf is bifacial and consists of a single layer of palisade tissue and two or more layers of spongy tissue. Stomata occur on both surfaces, being more numerous on the lower, sunk in pits. They are accompanied by two or more subsidiary cells, arranged transversely to the pore. The guard cells possess well-developed outer cuticular ridges.

Oxalate of lime is present in the stem as well as in the leaf in the form of minute acicular or octahedral crystals.

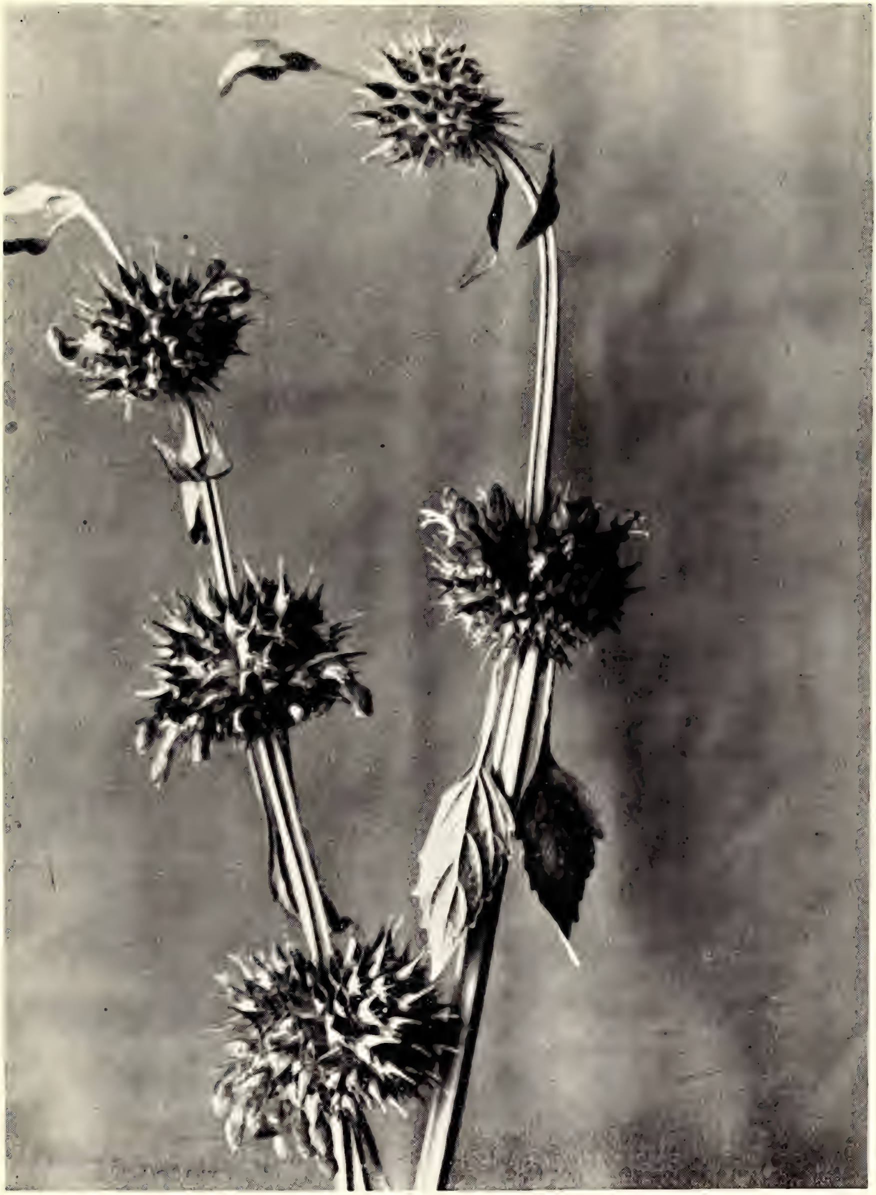
The hairy covering (Plate III, Figs. 1-3 and 5-7) consists of ordinary clothing hairs and capitate glandular hairs. They occur in the stem, leaf, and floral parts. The ordinary trichomes are uniseriate and either straight and long or smaller and bent at an angle to the stalk. Their basal cells are spherical and are seated on pedestals formed by several epidermal cells. The glandular hairs are of three types :—(1) with a small stalk and a spherical head which is divided by vertical walls into four or eight cells, (2) the same form except that the cuticle of the glandular head is raised like a bladder, owing to the accumulation of secretion (the integumental glands, Solereder, 8), (3) with a longer stalk and a spherical head divided vertically into two or four cells. The cuticle is not raised like a bladder.

Structure of the petiole and stem. In the petiole there is an arc of vascular bundles. The epidermis of the ridges of the stem is composed of thick-walled, narrow, vertically elongated cells (Plate III, Fig. 6), while that of the furrows consists of thin-walled, wide, parenchymatous cells (Plate III, Fig. 5). Stomata occur in the region of the furrows or grooves. The cortex is composed of collenchyma and chlorenchyma, the former is extensively developed in the four ridges, and the latter is more confined to the furrows. At the internal margin of the primary cortex an endodermis is present. Its cells show Caspary's dots. The secondary xylem is more strongly developed towards the four ridges or angles, and the medullary rays are narrow. The pith consists of unlignified parenchymatous cells. Cork is developed subepidermally.

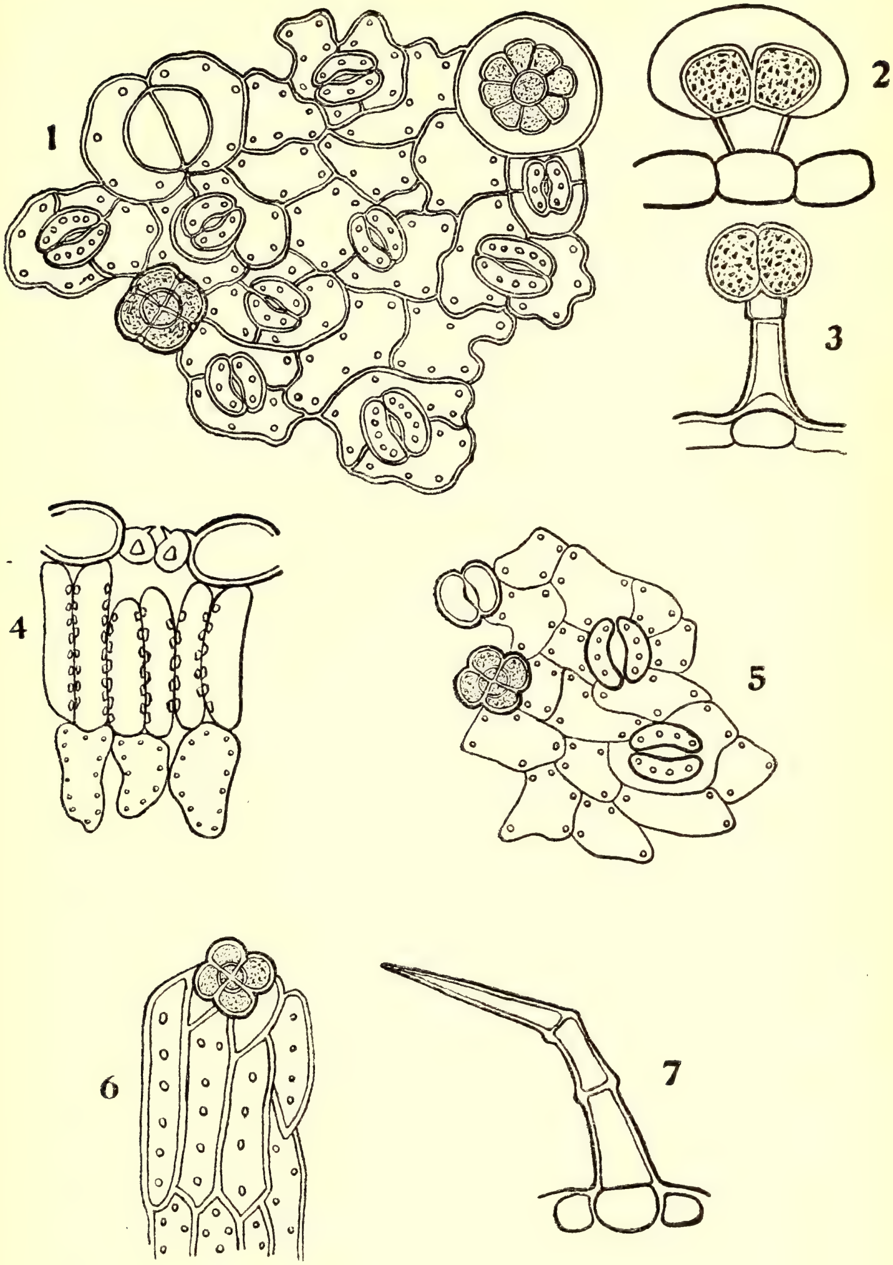
The above-mentioned observations tally a great deal with those of Mullan (6) on *Leuccas aspera* Spreng (Labiatæ) and conform to the anatomical characters of Labiatæ described by Solereder (8).

CONCLUSIONS.

The following features seem to be very characteristic:—(1) shortly stalked bladder-like integumental glands in which the



Sayeedud-Din—Common Indian Herbs: *Leonotis nepetaefolia* R. Br.



Sayeedud-Din—Common Indian Herbs.

For explanation see end of article.

head is composed of 4-8 cells. (2) capitate hairs with a unicellular or bicellular head. (3) simple uniseriate trichomes. (4) stomata with subsidiary cells lying transversely to the pore. (5) oxalate of lime in the form of small acicular or octahedral crystals. (6) typical collenchymatous tissue in the angles of the stem. (7) strongly developed secondary xylem in the same region. (8) presence of endodermis. (9) sub-epidermal development of cork.

ACKNOWLEDGMENTS.

My thanks are due to Mr. Sri Ramloo for the drawings which, as before, were prepared under my supervision. I am also thankful to my pupil, Mr. Riazul Hasan Qurieshi for the preparation of several microscopic slides.

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EXPLANATION OF PLATES I TO III.

Leonotis nepetaefolia R. Br.

PLATE I.

Fig. 1.—Black and white drawing of a part of the upper portion of *Leonotis nepetaefolia* R. Br. (Nat. size).

Fig. 2.—A leaf from the lower region of the plant.

Fig. 3.—Corolla opened out, showing three parallel rings of hairs, and stamens. (×2).

Fig. 4.—Pistil. (×2).

Fig. 5.—T. S. Ovary. (×2).

Fig. 6.—Fruit, showing nutlets. (×10).

Fig. 7.—Pollen grain in dry condition. (×600).

Fig. 8.—Pollen grain, moistened. (×600).

PLATE II.

Photograph of *Leonotis nepetaefolia* R. Br.

PLATE III.

Fig 1.—Leaf-epidermis, showing the glandular hairs and stomata in surface view.

Fig. 2.—Shortly stalked integumental gland.

Fig. 3.—Long stalked glandular hair.

Fig. 4.—T. S. Leaf, showing a stoma, the palisade and spongy tissue.

Fig. 5.—Stem-epidermis in the region of a furrow, showing wide epidermal cells, stomata and a glandular hair in surface view.

Fig. 6.—Stem-epidermis in the region of a ridge, showing elongated cells, and a glandular hair in surface view.

Fig. 7.—Clothing hair, curved type.

(all × 600)

(To be continued).

A NEW SPECIES OF FOSSIL FROG FROM THE INTER-TRAPPEAN BEDS OF WORLI HILL, BOMBAY.

BY

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(*Department of Geology, Benares Hindu University*)

(*With one plate*).

The species of fossil frog described here comes from the Frog Beds at the Worli Hill on the west coast of Bombay. A full account of these beds is given by Carter,[1] Buist,[2] Wynne[3], and Ribeiro.[4] These are fresh-water Inter-trappean shale beds belonging to the upper part of the Deccan Trap Series, and are probably of the early Eocene age. These shales are light to dark grey in colour, often rather fragile, fine to coarsely grained, much impregnated with carbonaceous matter, and are full of minute kidney-shaped carapaces of crustaceans. Among the fossils thus far recorded from these beds, are *Cypris semi-marginata* Carter, *C. cylindrica* (Sowerby), *C.* sp., *Platemys leithi* (Carter), *Indobatrachus pusillus* (Owen), an indeterminate large-sized species of frog,[5] some fresh-water gastropods probably referable to *Melania* and *Pupa,* some plant stem, seed and leaf impressions.

Though the earliest occurrence of the Salientia dates back to the upper Jurassic times,[6] their fossil record, on the whole, is very incomplete. This is due mainly to the fact that frogs in general make poor fossils. But, as the study of the present-day distribution of the frog fauna and the routes of migration and the lines of evolution of their various families, must take into consideration the palæontological evidence, it is of the utmost importance that every fossil find of the Salientia, howsoever poorly preserved, be critically examined and put on record.

In India fossil frogs have, since long, been known to occur in the Inter-trappean beds at the Worli Hill, Bombay. They were first described by Owen [7] in 1847, as *Rana pusilla.* Stoliczka[8] re-examined and transferred them to the genus *Oxyglossus* (or *Oxydozyga* as it is now known) which is found in south-eastern Asia and the neighbouring islands. Noble[1] in 1930 recognised the bufonid nature of these frogs and transferred them to the genus *Indobatrachus,* which was created for their reception.

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[1] Carter 1857, p. 116.

[2] Buist 1857, p. 169.

[3] Wynne 1866, p. 173; *ibid.* 1869, p. 385.

[4] Ribeiro 1921, p. 582.

[5] Dr. Leith found a part of the posterior extremities of a large-sized frog computed to be nearly three inches long, Vide Carter 1857, p. 139; Lydekkar 1887, pp. 68, 77.

[6] Woodward 1932, p. 231; Moodie 1912, p. 286.

[7] Owen 1847, p. 224.

[8] Stoliczka 1869, p. 386.

While studying the fossils collected by the present writer from the Worli Hill, associated with *Indobatrachus pusillus* (Owen), were found some specimens which differed from it mainly in having a less acutely rounded snout and a relatively longer vertebral column. These are described here as constituting a new species. The material available for study is in skeletal condition and rather ill-preserved. The cranium is crushed down in the plane of partings in the shale laminæ, rendering the various constituent bones obscured and rather difficult to be distinguished. The material was examined in xylol under a low-power microscope so as to bring out clearly the various details which cannot be observed on dry surfaces. In view of the frequent dislodgement of the head from the shoulders, and of the pelvis from the vertebral column, the lengths of these parts were measured separately to ensure the accuracy of the measurements.

The author very much regrets that the fossils and the matrix being very closely similar in the shade of grey, the photographs could not be better.

SYSTEMATIC POSITION.

That the specimens under consideration do not belong to the liopelmid frogs, is evident from the fact that they have eight pre-sacral vertebrae, no ribs and two condyles on the coccyx; the last character also excludes the pelobatids. Because of the pro-coelous vertebrae and the absence of the ribs in these specimens, the Discoglossidae are eliminated. The Pipidae are ruled out on the ground that our specimens have pro-coelous vertebrae. The broadly expanded diapophyses of the sacral vertebra clearly show that these frogs cannot be included in the Ranidae nor in the Polypedatidae. In most of the specimens available, all the digits are very well preserved, and the absence of any inter-calary cartilages or any space for them is beyond doubt; this excludes the Hylidae. The procoelous nature of the vertebrae is present in the Bufonidae and a few of the brevicipitid genera.[2] But, the pro-coelous nature of the vertebrae combined with the presence of the free inter-central discs, the arched clavicle divergent to the coracoid, the maxillary teeth and the broadly expanded sacral diapophyses clearly show that our specimens must be assigned to the Bufonidae and not to the Brevicipitidae.[3]

Though the cranial region is much crushed, it is possible, from an examination of a number of specimens, to verify the presence of the nasals, which were probably free, the palatines, the fronto-parietals separated by the median ethmoid and the T-shaped para-sphenoid; further, the presence of teeth on the maxillaries, pre-maxillaries and on the pre-vomers is clearly indicated by sockets. These features along with the above-mentioned bufonid characters show that these specimens under consideration belong to Noble's genus *Indobatrachus.*[4]

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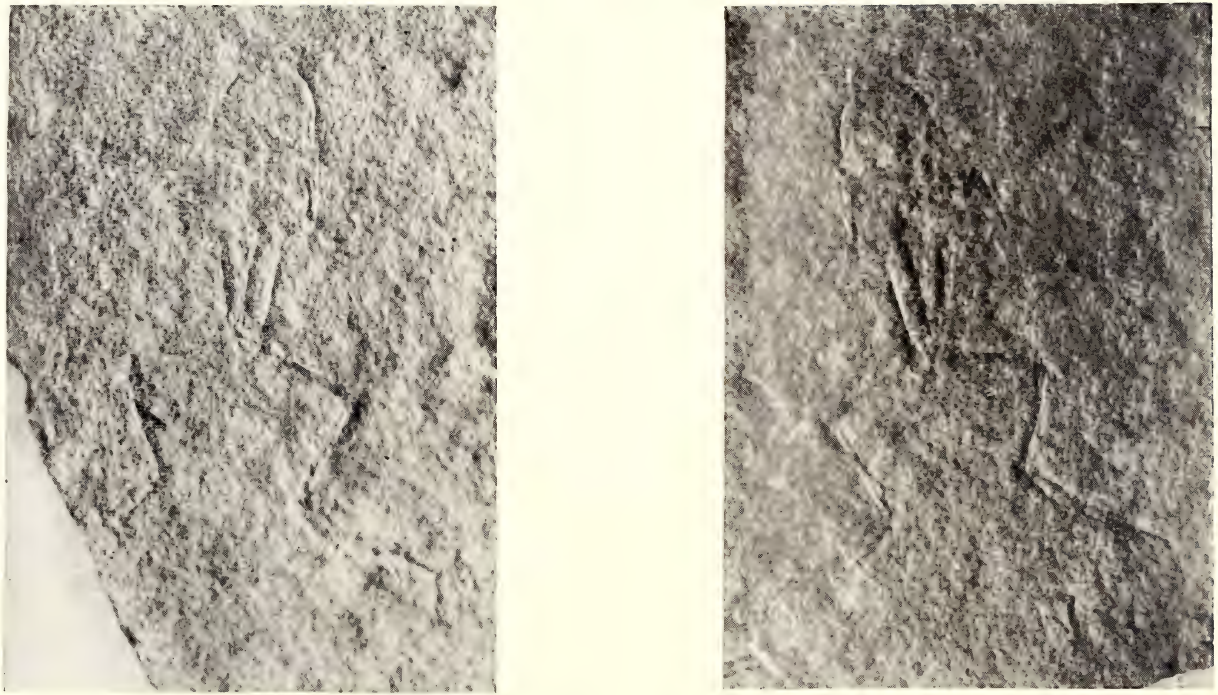
[1] Noble 1930, p. 2.

[2] Gadow 1923, pp. 143, 152, 160, 185, 237.

[3] Noble 1930, pp. 4-7; Gadow 1923, p. 166.

[4] Noble 1930, pp. 2-9.

NEW SPECIES OF FOSSIL FROG.



Indobatrachus trivialis sp. nov., approx. ×1½

DESCRIPTION OF THE SPECIES.

Family: Bufonidae.

Genus *Indobatrachus* Noble, 1930.

Indobatrachus trivialis sp. nov.

Pl. I. fig. 1.

Description:—The head is large, anteriorly rounded off rather obtusely, and has its posterior width only a little more than its length. The teeth sockets are seen on the maxillaries, pre-maxillaries and on the pre-vomers—on the last they are rather obscure. The presence of the various investing bones can be verified as mentioned above, by examining a series of specimens; but they do not permit of any detailed description.

The vertebral column consists of nine pro-coelous vertebrae, which are broader than long and have well marked zygapophyses. The third vertebra has its diapophyses a little longer than those of the fourth and the fifth vertebrae. The sacral diapophyses are broadly expanded. Between some of the vertebrae are seen minute discoid elements which are most probably the free intercentral discs. The cocoyx has two condyles and no lateral processes. The length of the pelvis is slightly more than half of that of the vertebral column.

The humerus is nearly as long as the supra-scapula. The femur is a little shorter than the tibia-fibula. Of the meta-tarsal bones, the fourth one is the longest and the first one is the shortest; the second meta-tarsal is a little more than half the length of the fourth one, while the third and the fifth are sub-equal to each other. No inter-calary cartilages nor any space for them, is present. The phalanges are tapering and have minute terminal knobs.

In Table No. I are given the available measurements for five of the specimens representing the present species. The Table No. II gives the ratios of the measurements of the different parts of *Indobatrachus trivialis* sp. nov. and of *I. pusillus* (Owen).

COMPARISON.

To compare *Indobatrachus pusillus* (Owen)[1] with the present species, the first striking difference is found in the ratio of the length of the vertebral column to that of the pelvis, which is 181-183/100 in the new species and 150-153/100 in *I. pusillus* (Owen); this gives to the new species a little longish appearance as compared to *pusillus*. The ratio of the length of the head to its width is fairly different, being 94-95/100 in *I. trivialis* and 97/100 in *I. pusillus* (Owen). Again, the ratio of the length of the femur to that of the tibia-fibula is 96-97/100 in the present species and 100/100 in *pusillus*. Further, the species described here has slightly stouter bones than *pusillus* (Owen).

GEOLOGICAL AGE.

The lower Eocene age of the upper part of the Deccan Trap Series (which includes the Frog-Beds of Bombay) is to be accepted as very probable, since they are unconformably succeeded by the Nummulitics of Surat and Broach.[2] The genus *Indobatrachus* has its nearest allies in some of the living Australian bufonid genera.[3] This relation as Noble points out, is of very great zoogeographic importance;[4] but unfortunately it does not help us to fix the age of the Inter-trappean Beds of Bombay, on the basis of this genus. It is, however, to be hoped that some direct evidence bearing on this problem will come forth from the study of the crustacean fossils from these beds, with which the author is now busy.

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[1] Noble 1930, pp. 2-9.

[2] The upper Eocene age assigned by Woodward (1932, p. 231) to *Oxyglossus pusillus* cannot be accepted.

[3] Noble 1930, pp. 2, 8.

[4] *Ibid.* p. 2.

TABLE NO. I

	Indobatrachus trivialis sp. nov.				
	1	2	3	4	5
Total length of the body	20·3 mm.	20·65 mm.	18·4 mm.	17·0 mm.	17·6 mm.
Length of the head	5·7 ,,	5·83 ,,	5·2 ,,	4·8 ,,	4·9 ,,
Posterior width of the head	6·0 ,,	6·2 ,,	5·5 ,,	5·1 ,,	5·2 ,,
Length of the vertebral column	13·8 ,,	14·0 ,,	12·5 ,,	11·61 ,,	12·0 ,,
Length of the pelvis	7·6 ,,	7·73 ,,	6·84 ,,	6·33 ,,	6·6 ,,
Length of the humerus	4·6 ,,	4·67 ,,	4·1 ,,	3·8 ,,	...
Length of the radio-ulna	3·2 ,,	...	...	...	...
Length of femur	6·2 ,,	6·4 mm.	5·6 mm.	5·2 mm.	...
Length of the tibia-fibula	6·4 ,,	6·6 ,,	5·8 ,,	...	...
Length of the calcanum-astragalus	3·4 ,,	3·42 ,,	...	...	...
Length of 4th meta-tarsal bone	3·3 ,,	3·32 ,,	...	...	...
Total length of the posterior limb	27·5 ,,	27·68 ,,	...	...	...

TABLE No. II

—	*Indobatrachus trivialis* sp. nov.	*Indobatrachus pusillus* (Owen) *			
		From measurements of Owen's figure	From Noble's figure; Brit. Mus. specimen No. 35107*a*	Brit. Mus. specimen No. 35107	Brit. Mus. specimen No. 3084
$\frac{\text{Skull length}}{\text{Width}}$	$\frac{94-95}{100}$	$\frac{97}{100}$	?	?	?
$\frac{\text{Femur}}{\text{Tibia}}$	$\frac{96-97}{100}$	$\frac{100}{100}$	$\frac{100}{100}$	$\frac{99}{100}$	$\frac{100}{100}$
$\frac{\text{Hind limb}}{\text{Body}}$	$\frac{134-136{\cdot}5}{100}$	?	$\frac{138}{100}$	$\frac{135}{100}$	?
$\frac{\text{Vert. col.}}{\text{Pelvis}}$	$\frac{181-183}{100}$	?	$\frac{152}{100}$	$\frac{150}{100}$	$\frac{153}{100}$

* The ratios given below for this species were very kindly supplied by H. W. Parker, Esq., Keeper of the Reptiles Section British, Museum, for which the author is much thankful.

ACKNOWLEDGMENTS.

In conclusion, my sincere thanks are due to Dr. Raj Nath, Head of the Department of Geology, Benares Hindu University, for his keen interest in the present work. I am much thankful to H. W. Parker, Esq., Keeper of the Reptiles Section, British Museum (Natural History), for his valuable criticism and to the Director, the Geological Survey of India, for loan of books from the Survey library.

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EXPLANATION OF PLATE NO. I.

Fig. 1.—*Indobatrachus trivialis* sp. nov., approx. x 1½.

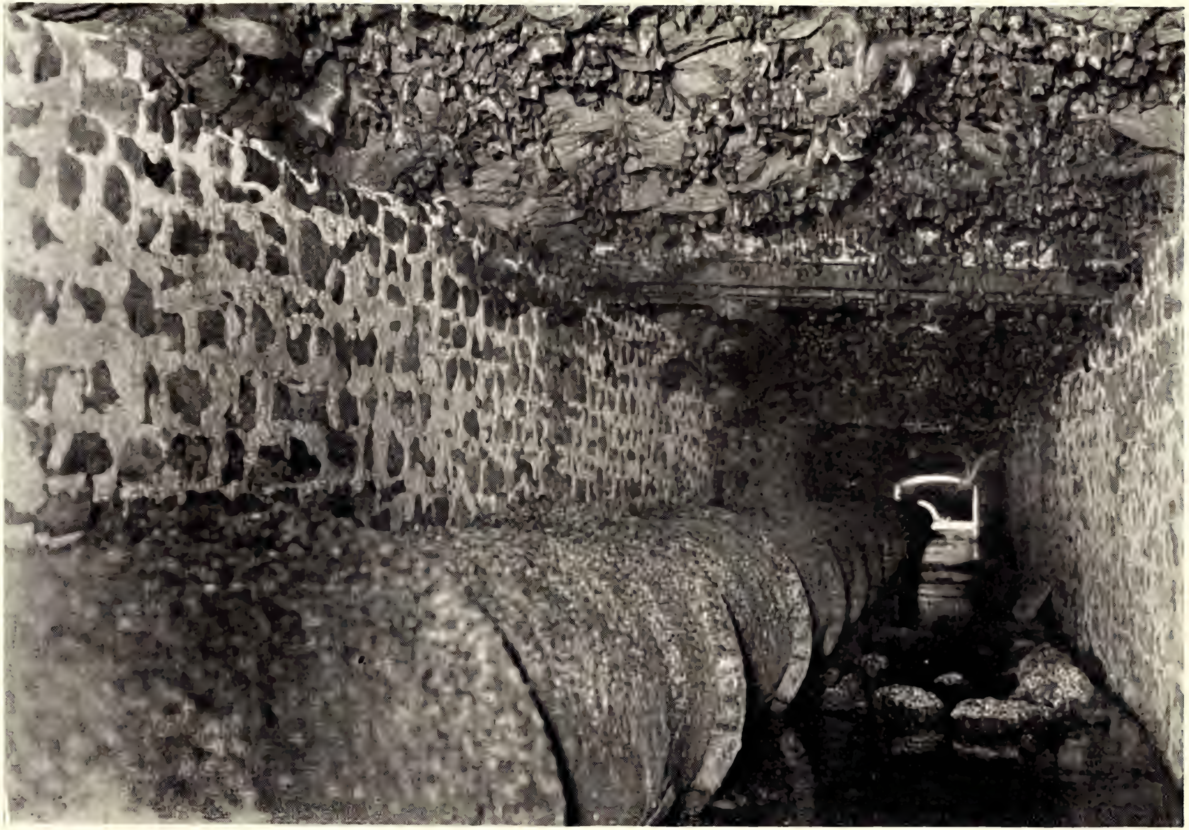

Photo: *C. McCann.*

A roost of the Fulvous Fruit-Bat (*Rousettus leschenaulti* Desm.) in a tunnel south of the Tulsi Lake, Salsette Island. (Most of the animals had flown further in).

NOTES ON THE FULVOUS FRUIT-BAT (*ROUSETTUS LESCHENAULTI* DESM.).

BY

CHARLES McCANN, F.L.S.

(*With one plate and one text-figure*).

The Fulvous Fruit-Bat (*R. leschenaulti*) is one of the smaller fruit-bats commonly seen in Salsette Island. During the day it tenants disused caves and tunnels. At the roosts the bats usually congregate in fair numbers, both sexes sharing the same retreat. But in the Tunnel near the Tulsi Lake, where these observations were made, I sometimes got a net full of males only at one spot and only females at another, which seems to suggest that the sexes congregate separately.

The largest assemblage I have ever seen, was in the tunnel cut through a hill for an outlet pipe south of the Tulsi Lake. Here there were actually thousands hanging in dense clusters from the roof of the tunnel one against the other, or even one on top of the other like bunches of grapes! The incessant squealing of the animals, as they fight for space, is continuous. The pipes and the surrounding rocks are covered thick with excreta. As water flows through the tunnel alongside the pipes, the air inside is damp and strongly permeated with a foul 'batty' odour, which assails one long before entry into the tunnel. Inside, the air is alive with winged bat-parasites which settle on the intruder; while the walls are crawling with wingless forms; wings whiz by and missiles pass at top speed—just bats and bats, hurrying to safety further into the tunnel, or out of it into the open. With a torch one runs the risk of the dazzled bats hitting one in the face or settling in numbers on one's person, but one has little to fear, for the bats are fairly good-natured and do not readily bite. The Tulsi Lake tunnel has to my knowledge been occupied exclusively by this fruit-bat for over twenty years. Other localities in Salsette where I have noted this bat roosting are the Kanari and Makal caves.

Mr. C. A. Crump[1], one of the Society's collectors on the Mammal Survey, found this bat also in thousands in a tunnel at Tanakpur, Naini Tal District. He wrote as follows:—

> 'There were several thousands of these bats in a long tunnel through which flowed a canal. The bats, driven towards me by men carrying lanterns, came on in a mass, their screeches and the beating of their wings filled the tunnel with an almost deafening noise. I had no difficulty in filling several butterfly nets with specimens both male and female, most of the latter being heavy with young.'

Another of the Society's collectors, Mr. G. C. Shortridge[2], records the following from Pagan, Burma:—'A large colony was found in an old Pagoda at Pagan, where they roosted in company with

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[1] *Journ. B.N.H.S.* xxiii., 286.
[2] *Ibid.*, 465.

Taphozous kachhensis.' At the Kanari caves, I have found them in a cave occupied by *Taphozous melanopogon* Temm., and at the Makal caves in a cell occupied by a species of *Hipposideros.*

In general colouring this bat is a dusky brown with little or no variation, except that the underside is slightly paler than the upper. The wings are a darker brown than the body fur, but the phalanges are demarcated in a lighter tone. Young animals[1] are coloured like the adults. The skin covering the nape and the area between the scapulars is sparsely clad or naked. Preserved specimens (cabinet specimens) fade considerably and there is always a distinct light collar behind the ears—the sparsely clad area. This bare patch is not evident in living specimens. Some specimens, particularly old males, are almost naked or thinly clad in areas over the pectoral and rump regions. I have seen several almost entirely naked. It is difficult to account for this general nakedness, but it seems possible that the conditions under which the animals live, in close contact and constant scrambling over one another, plus the complement of parasites, contribute to their condition. I could discover no skin complaint that would explain it. However, there is one point which is clear and that that the males exhibit this condition much more than females.

As far as I have been able to discover there is little difference between the sexes, except that the adult males appear larger, a statement supported by the table of measurements, but this difference is small. Another slight difference is that males have a slight ruff round the throat, again a slight characteristic. The gular region in both sexes (adults) may be yellowish or not, but this character in skinned examples may disappear or become slightly russet. The eyes are dark brown with a small black pupil, but the brown is so intense that the eyes appear like 'black' beads. The wing span may vary from 20-22 inches (50-60 cm.).

The bats are infested with winged and wingless parastitc flies. The winged ones belong to the *Streblidae* and are known as *Nycteribosca gigantea* Speis. They are bright yellow. These flies live more on the surface, and feed on the naked areas, particularly the wing membranes, which show the marks of their attacks. The wingless flies are less showy, live buried in the fur, and only move when disturbed. They belong to the *Nycteribidae—Eucampsipodia hyrtli* (Kelonati). The development of the forelimbs into organs of flight has certainly given the bats an advantage over other mammals, but not without a sacrifice. They are doomed to view the world upside down and use their feet as organs of suspension and little else. The wings are useless as scratching implements and therefore bats have a poorer chance of dealing with body parasites than most quadrupeds! Thus it is they have to submit to a host of body parasites which run about freely, almost unmolested, one is tempted to say, for the bats do not appear to worry much about them. So far I have not discovered any parasitic worms in the alimentary canal. Several of the bats caught were blind in one eye, apparently the result of injury from a neighbour's claws. The parasites do not appear to take to human hosts.

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[1] Those nearly mature.

BREEDING.

Anderson[1] on *Rousettus* writes, 'Scarcely anything is known about the habits of the Oriental and Austro-Malayan species', and I can find no reference to the breeding of *R. leschenaulti*. In Salsette, the general breeding season of *leschenaulti* is undoubtedly during the cold months, i.e., December to March; I have repeatedly taken gravid females in January and February. Fresh observations made recently have confirmed this. Incidentally Crump's statement, quoted above, shows that the breeding season at Tanakpur coincides with that of Salsette. On the 21 January 1940, Mr. J. Alfrey and I visited the Tulsi tunnel and I secured nine gravid females with well-formed foetuses (one in each). Breeding at this period is evidenced by the condition of the testes which are prominent and considerably enlarged in mature specimens, each body measuring 12-18 mm. In a few males (4 examples) I observed that only one testis was developed, the right, whereas the other was barely the size of a pea. I have not observed the act of copulation, but Anderson (l.c.) describes it in the case of an allied species *R. leachi* which bred in captivity in the zoological gardens, London and Cologne, as follows:—

> 'During the act of copulation the male is suspended (as usual by the hind feet) behind the female, its underparts being in contact with the lower back of the female; an embracing with the anterior extremities does not take place; period of gestation (in one case, Cologne gardens) precisely 15 weeks after last copulation.'

In Salsette the majority of the young appear to be born about the middle of March or after. On 3rd March (1940) Mr. Alfrey and I revisited the Tulsi tunnel for further details and specimens. All females were heavily gravid. The foetuses were large, apparently close on their time, but the skin of the foetuses was not pigmented. I kept several of the bats caught that day in the hope of obtaining newly born young, but this hope was soon frustrated as all the bats aborted; only one was born alive, and this too was unpigmented, which clearly showed it was slightly premature. Except for the whiskers this young one was devoid of all hair. Its eyes were closed and it squealed from time to time, but the parent completely disregarded it. Some of the foetuses were partially eaten including the afterbirth, but only the soft membranes were taken. The eating of foetal membranes is common to most mammals and is well-known. This habit is believed to stimulate the secretion of the lacteal glands.

On the 10th March (1940) we again visited the tunnel. Many females were still gravid. Dissection of two of them showed that the foetuses were by this time almost full term; the skin was strongly pigmented over the dorsal area. With a lens a covering of short hair was clearly visible. The underside, ears, and snout remained a flesh pink.

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[1] *Cat. of Chiroptera in the coll. of the B. M.* Vol. I (1912) 21.

We revisited the Tulsi tunnel again on the 17th March (1940). A number of females were now carrying newly born young, numbers were still gravid. I secured four females with newly born young and two containing foetuses. The two foetuses indicated that they were very close on their time, perhaps they would have been born in a day or two. The dorsal area was clothed in a dense crop of short hairs. All males examined on this day showed a considerable decrease in the size of the testes.

When the bats were in flight the newly born young could be clearly seen as dark patches against the lighter underside of the parents. The newly born is a dark ashy brown or dark slate grey above. The dorsal surface is deeply pigmented as already observed earlier. The ventral area is almost nude, particularly about the abdomen, but in the thoracic region there is a thin barely visible covering of short whitish hairs. The skin is flesh pink. At first the snout and ears are pinkish like the abdomen, but soon become pigmented. The wings are lighter in tone than the body.

The young bat is generally huddled up on the right or left side of the mother's body depending on which nipple it is fixed to at the time. The nipple is kept constantly in the mouth and forms a means of attachment to keep the young in position during flight, but its feet are its main support. One leg is stretched across the abdomen of the mother, the hooked toes securing a firm hold on the pelvis; the other is folded under its own body with the toes pointing forward, thus that when the bat changes its position from one side to the other the folded foot automatically stretches out to the holding position. The wings take no part in securing the position of the young. Clinging in this fashion the young does not interfere with the flight of its parent. The teeth are slightly errupted and assist in securing the hold on the base of the nipple. At this stage the eyes are usually half closed. The measurements of the young taken on 17 March, given in the accompanying table, indicate that the young are born only when they are almost half the size of the parent, which seems to show that the period of parental care is considerably shortened; a necessity, perhaps in a volant animal which must carry her offspring about till it is able to fly. The young has a call quite different from that of the adult—a call that is difficult to describe.

On 7 April (1940) we made yet another 'assault on the battery' to see what further observation could be made. My companion, Mr. Alfrey, was chiefly interested in butterflies, but we invariably ended our day catching these 'mammalian butterflies' in nets wholly unsuited for the purpose—it generally meant providing a new net or frame for the next occasion. After examining some forty specimens I selected eleven for further examination and preservation. Of these nine were females with young and two old males. Most females, if not all, had by this time given birth—no gravid individuals were observed. An examination of the young indicated a general increase in size (see table) and a further covering of fur; their eyes were fully open; and they were more active than those collected previously, but they were yet quite incapable of flight. The dorsal fur was denser and of a smoky brown hue, that of the lower surface was greyish.

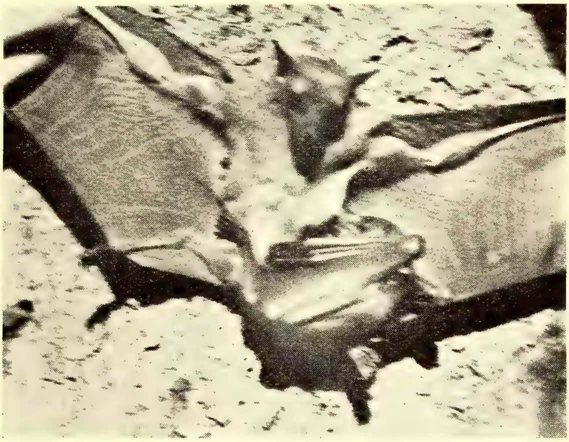
One of the females died overnight, next morning I found another female suckling two young! The young one had deserted the body of its mother and gone to another. Whether such an example of fostering would take place in nature is difficult to say—I doubt it.

On the 12th May we disturbed the peace of the tunnel for the last time. By this time the majority of the young had left their parents to lead an independent life. Some were still being suckled, but flew off on their own on our approach. A few were still being carried about in spite of their size. No. 40A is a good example (see table and photo). As the newly born young were first observed on 17th March and the young were still being carried about by the parents on 12th May, this indicates that the young remain with the parents for approximately two months.

By this time the genitals of the males had almost 'atrophied'. A large cockroach *Periplanata* sp. was fairly plentiful in the depths of the tunnel.

Mr. Phillips[1] referring to the breeding of *R. seminudus* in Ceylon writes:—

> 'The period of gestation is said to be fifteen weeks. For the first week or so after birth the single young one remains suspended from or clinging to, the mammae of its mother, but as it becomes older and heavier, it is probably left behind at the roosting place to await its mother's return from feeding.'



[2] *Rousettus leschenaulti* Desm. Mother and young, nos. 40, & 40A.

The suggestion that the young remain with the parent for only 'a week or so after birth' and that the young are then left behind at the roosting place till the parents return, does not agree with my observation on *leschenaulti.* The bats caught on the 17th March were carrying newly born young, those examined on the 7th April, three weeks later, were carrying much larger young and flew about with them without any difficulty. It seems most unlikely that the young are left behind at the roosts. What a confusion there would be at the nursery when on the return of the bats they endeavour to seek out their respective young among hundreds! The young do not desert the parents till they are able to fly and fend for themselves. That parental care is comparatively short seems to be indicated by the size of the young at birth.

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[1] *Manual of the Mammals of Ceylon* (1935) p. 70.

[2] *Photo from life.*

Food.

The question of breeding naturally leads to a consideration of the food, as these two factors, breeding and food-supply, are most intimately linked. What then is the food of this bat? Its name implies it is a fruit-feeder; the [1]*Fauna* (Blanford) says, 'Like the other fruit-bats, this animal is very voracious and possesses great powers of flight'.[1] It is a common belief that fruit-bats *consume* large quantities of fruit, but my observations on the largest of the fruit-bats, the Flying-Fox,[2] has convinced me that this general conception needs explanation. The Flying-Fox subsists almost exclusively on *fruit juices* and *nectar,* rejecting all solid pulp and seeds after mastication, except in the case of fruits that liquefy readily. This appears to be the case also with *Rousettus*. An examination of the stomach contents yielded nothing solid. If bats did eat fruit entire, we might reasonably expect that their comparatively small stomachs would be very soon full of solid matter. If they gorged themselves they would be hampered in flight. The litter under a tree where bats have been feeding is due to the habit of mastication and rejection of solid matter after the juice has been extracted.

About thirty specimens were kept in captivity for a week. During this time they were fed on pawpaws and plantains, which they ate greedily. The following observations were made. The bats before biting out pieces of the fruit did much licking with the long rasp-like tongue. Then large chunks were bitten out overfilling the mouth till the cheeks bulged and parts of the fruit protruded on all sides. The bat would then retire to finish the mouthful. Hungry companions try to help by licking at the protruding fruit and then trying to bite off a share. Such assistance was resented. The bat moved away and, when done, it turned round, suspended itself with its 'hooks' excreted, and then returned to the fruit to resume its meal. While feeding the bats excrete frequently indicating a rapid passage of the food through the alimentary canal. In doing so they always turn round and suspend themselves by the hooks of one or both wings, some assisted by one or both feet. The seeds of the pawpaw were also chewn to extract the juice in the surrounding skin, but the seeds and skins were rejected. When at rest the animals huddled together in compact masses just as they did in the tunnel. In the cage they did not seem to mind the beam of an electric torch after a while. In the natural state they immediately take to flight, much sooner than Flying-Foxes do when a torch is turned on to them.

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[1] *F.B.I.* (Mammalia) p. 262.

[2] *Journ. B.N.H.S.* xxxvii, p. 143.

POLLINATION OF FLOWERS.

This bat, like the Short-nosed Fruit-Bat[1] (*Cynopterus sphinx*) is one of Nature's 'pollinators'. Just as some birds and insects assist in the pollination of certain flowers, so also we find some of Nature's agents among the smaller mammals, perhaps particularly among the bats. Some flowers are so adapted, and their dependence so linked with pollinating agents, that without them these plants would soon be extinct! Thus we find certain flowers are especially adapted for bat pollination. During the flowering period of the Silk Cotton Tree (*Bombax Ceiba* L.) and an allied species *Ceiba pentandra* Gaertn, I have observed numbers of these bats visiting the flowers for the sake of the ample secretion of nectar, which is most profuse towards sunset. Likewise, I have seen them hovering round the flowers of *Bassia latifolia* L., some Bignoniaceous and Sapotaceous trees, before settling down to feed. Some of these trees flower just when the bats are in full breeding condition and later when the females are suckling young. Thus we see the intimate relation between the breeding season and the food-supply. The fruit of the Custard Apple (*Anona squamosa* L.) and allied species, the fruit of the Sapodilla Plum (chikū) and a few others are attacked just when they are on the verge of ripening. Thus it is that this bat crosses the path of man and does much damage in fruit gardens. To destroy the bats on this account would not be a difficult matter once the roosts are discovered, but let us pause before such a step is ever taken as their extermination may be a costly experiment in other fields which cannot be foreseen before the problem is thoroughly understood.

On the authority of Layard, Anderson (l.c.) writes, 'in default of fruit it devours insects, snapping them off flowers and leaves without alighting.' This to my mind is a misinterpretation of actual facts. The bats certainly do a lot of hovering before alighting, but they are after nectar, not insects, it is an examination flight. Again there is a statement in the *Fauna* which reads, 'Dobson was informed that near Moulmain a colony of *X. amplexicaudata* (=*R. leschenaulti* in part) was found to feed on mollusca left exposed by the tides.' This is a similar statement to that made about the 'fishing' propensities of the Flying-Fox (see my paper[2]). Anderson uses this hearsay evidence as a possible explanation for the occurrence of an allied species *R. arabicus,* inhabiting Kishm Island in the Persian Gulf; he writes, 'this would seem to explain the occurrence of an allied species (*R. arabicus*) in so dreary a desert as the island of Kishm, Persian Gulf, where an exclusively fruit-eating mammal could hardly exist.' With regard to Blanford's statement I do not think that members of the same species are likely to differ so widely in respect of diet—animals are a lot more conservative. The habit of dipping down to expanses of water for a drink is not restricted to bats, but is commonly witnessed in the case of swallows and swifts. This habit may easily be misinterpreted as attempts at fishing. The bats were either after a drink of water, and mistook the glisten for a stretch of fresh water, or perhaps they were after a 'salt sip', just as terrestrial animals will lick rock salt. With regard to the bats of Kishm Island and Anderson's suggestion, it might be pointed out that the island in question is close to the mainland, within about 20 miles. *Rousettus* is a fast and powerful flier and consequently would not find much difficulty in crossing to the mainland where it would probably be able to find a source of food. The Flying-Fox, which is a heavier and slower flier than *Rousettus,* is known to undertake long journeys to and fro from its roost to its feeding grounds. Again, *Rousettus* is much earlier on the wing than most fruit-bats, appearing at or soon after sundown when there is still a bright glow in the sky, an habit which would give it an early start to cover long distances.

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[1] *Journ. B.N.H.S.* xxxv, p. 467.

[2] *Journ. B.N.H.S.* xxxvii, p. 143.

[1]LIST OF PLANTS VISITED BY ROUSETTUS.

Species.	Flowering and Fruiting.	Parts attacked.
Anona squamosa L.	July-August	Ripening fruit.
Anona reticulata L.		
Adansonia digitata L.	Late May-July	Flowers.
Bombax Ceiba L.	Late Dec.-early April	Flowers.
Ceiba pentandra Gaertn.	Dec.-January	Flowers.
Eugenia jambolana Lamk.	Late May-June	Flowers and fruit.
Psidium Guyava L.		Flowers and ripening fruit.
Careya arborea Roxb.	March-May	Flowers.
Bassia latifolia L.	March-April	Flowers.
[1]*Mimusops hexandra* Roxb.	Nov.-Jan.	Fruit.
[2]*Achras Sapota* L.	More or less throughout the year	Fruit.
Oroxylum indicum	May-July	Flowers.
Heterophragma Roxburghii DC.	Feb.-April	Flowers.
Radermachera xylocarpa K. Schum.	March-May	Flowers.

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[1] The flowering and fruiting periods of the plants vary slightly with the climatic condition from year to year. Flowers, it should be noted, are visited for nectar.

[2] It is doubtful whether *leschenaulti* pollinates the flowers.

The two species of *Sonneratia* (*apetala* and *acida* occurring in the mangrove swamps are probably visited by these bats also.

Though pawpaws and plantains are eaten in captivity, I have no record of these bats damaging either fruit crops. This, however, may be explained by the fact that both these fruits are generally removed from the trees before they are ripe, and the milky juice in the skin of pawpaws and the acrid juice of raw plantains act as deterrents. In passing it might be of interest to note that though India has its full complement of fruit-bats no damage is done to the mango crop, while in Australia (Queensland) the local Flying-Foxes do considerable damage to the mango crops. This may be explained by the fact that the fruit are allowed to ripen on the trees in Australia (so I was informed) while in India the fruits are removed before they are ripe. Another singular difference is that the Indian Flying-Foxes generally roost in or near villages, whereas the Australian live in the mangrove swamps away from humans, and the roosts are not easy of access.

GENERAL.

Before concluding I wish to draw attention to a few minor anatomical details. *Rousettus* is able to put out its tongue to a considerable length, a useful accomplishment for a nectar feeding animal. Towards the middle of the tongue there is a roughly diamond-shaped area covered with oblique rows of broad, sharply tridentate papillae. Surrounding this area are rows of flat-topped papillae, the margin of the flat top being fimbriated; towards the throat the papillae become more simple, just sharply pointed, particularly along the sides. Another anatomical detail is the structure of the teat. It is large, ovate, and considerably compressed, the flattening being along the long axis of the body. Its free portion is firm and below this slightly hardened portion it is soft. The young one takes the entire firm part into its mouth and the extremity of the jaws close over the nipple on to the softer area, thus giving the young a firm hold.

The position of the foetus is as follows: The chin rests on the chest; the feet are folded over the abdomen; the wings are folded with the 'wrist' of the left resting under the base of the left ear. The right 'wrist' is on a higher level than the left with the claw of the pollex or thumb resting on the centre of the crown of the head. The entire foetus lies slightly obliquely across the abdomen, the head being usually situated on the left side.

At what age these bats reach sexual maturity is perhaps difficult to say, but from a rough estimate, after comparison, I am inclined to the opinion that they become sexually mature by the end of the second year, or the third breeding season after birth (including the season in which they were born as the first).

Finally, I wish to express my thanks to Mr. J. Alfrey for his company and assistance in the field, and to Dr. Baini Prashad for the identification of the parasites at his institution. The specimens on which this paper is based, I have deposited in the collection of the Society, with the exception of Nos. 27 and 28, 23A, 24A and

Measurements of Rousettus leschenaulti *Desm.* in millimeters (57 specimens).

Coll. No.	Species	Sex	Date	H. B.	T.	F. A.	E.	Remarks
1	*Rousettus leschenaulti* ...	♂	21–1–40	122	18	83	19·5	Mature males with the testes highly developed. Average of eight H. B. 123; F. A. 85·5. Largest H. B. 127; F. A. 89. Smallest H. B. 119: F. A. 83.
2	Do. ...	♂	do.	120	12	85	21	
3	Do. ...	♂	do.	125	15	87	22	
4	Do. ...	♂	do.	122	12	85	21	
5	Do. ...	♂	do.	125	18	85	20	
6	Do. ..	♂	do.	119	17	83	19	
35	Do. ...	♂	7–4–40	125	17	89	20	Mature males showing a considerable reduction in the size of the testes at this period. These two specimens very nude. No. 37 had a span of 600 mm.
37	Do. ...	♂	do.	127	18	87	18	
18	Do. ...	♂	21–1–40	112	14	73	20	Immature males with the organs suppressed.
19	Do. ...	♂	do.	105	12	72	17	
20	Do. ...	♂	do.	110	13	70	19	
21	Do. ...	♂	do.	113	14	79	20	
22	Do. ...	♂	do.	116	15	79	20	
30A	Do. ...	♂	7–4–40	76	9	54	15	Young male sucklings.
31A	Do. ...	♂	do.	67	7	44	13	
33A	Do. ...	♂	do.	76	11	54	15	
36	Do. ...	♂	do.	70	11	49	14	Wing span 239 mm. young of 23.
23A	Do. ...	♂	17–3–40	63	6	40	11	,, 212 mm. young of 24.
24A	Do. ...	♂	do.	58	6	33	10	Newly born young.
25A	Do. ...	♂	do.	61	7	34	11	Wing span 215 mm. young of 25.
26A	Do. ...	♂	do.	60	8	35	11	,, 222 mm. young of 26.
40A	Do. ...	♂	12–5–40	86	7	66	14	,, 404 mm. young of 40.
7	Do. ...	♀	21–4–40	120	15	82	19	Females containing embryos.
8	Do. ...	♀	do.	118	11	77	19	
9	Do. ...	♀	do.	116	17	80	19	
10	Do. ...	♀	do.	123	16	80	20	
11	Do. ...	♀	do.	117	14	81	20	
12	Do. ...	♀	do.	116	12	84	19	
13	Do. ..	♀	do.	113	13	80	19	
14	Do. ...	♀	do.	121	17	83	19	

15	Do.	...	♀	21–4–40	117	13	79	19		Average of 23, H. B. 117·3 ; F.A. 81·1 : Largest H.B. 123 ; F.A. 86. Smallest H.B. 113 : F.A. 77.
23	Do.	...	♀	17–3–40	118	12	82	19	Mature females with newly born young.	
24	Do.	...	♀	do.	117	12	81	20		
25	Do	...	♀	do.	117	13	80	19		
26	Do.	...	♀	do.	119	14	80	19		
27	Do.	...	♀	do.	116	16	86	18	Females suckling young.	
28	Do.	...	♀	do.	117	13	85	18		
29	Do.	...	♀	7–4–40	115	16	80	20		
30	Do.	...	♀	do.	113	16	81	19		
31	Do.	..	♀	do.	116	20	79	18		
32	Do.	...	♀	do.	119	20	81	18		
33	Do.	...	♀	do.	117	14	85	19		
34	Do.	...	♀	do.	119	14	81	18		
38	Do.	..	♀	do.	119	18	79	19		
39	Do.	...	♀	do.	115	17	80	19		
16	Do,	...	♀	21–1–40	102	17	69·5	18	Immature females.	
17	Do.	...	♀	do.	94	13	68	18	Wing span 440 mm.	
40	Do.	...	♀	12–5–40	115	12	81	19		
29A	Do.	...	♀	7–4–40	77	11	56	15	Young at the parents breast.	
32A	Do.	...	♀	do.	73	11	57	14		
34A	Do.	...	♀	do.	73	9	53	13		
38A	Do.	...	♀	do.	73	10	53	13		
39A	Do.	...	♀	do.	76	10	57	16		
41	Do.	...	♀	12–5–40	98	14	71	18·5	Young that had recentiy left parents	
42	Do.	...	♀	do.	97	14	70	17		
43	Do.	...	♀	do.	95	13	69	17		
44	Do.	...	♀	do.	100	16	69	17·5		

Measurements of Rousettus leschenaulti *Desm.* in millimeters (57 specimens).

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17	Do. ...	♀	do.	94	13	68	18	Immature females.	
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43	Do. ...	♀	do.	95	13	69	17		
44	Do. ...	♀	do.	100	16	69	17·5		

the embryological material, which I have forwarded to Dr. W. C. O. Hill, M.D., of Colombo, Ceylon, for study.

APPENDIX: THE STATUS OF *Rousettus seminudus* GRAY.

Mr. R. C. Wroughton records three species of *Rousettus,* namely, *R. arabicus, leschenaulti* and *seminudus* as occurring in Indian and Ceylonese limits. Of these *R. arabicus* has been recorded from Karachi and adjacent country; *leschenaulti* throughout India and Burma, but *seminudus* is said to be exclusively Ceylonese! Wroughton's key[1] to the species separates *leschenaulti* and *seminudus* as follows:—

> "B.—Pollex 24-30 mm.; second phalanx of third digit 36-47·2 mm.
> (*a*) Fur on nape and shoulders not usually sparse; forearm 80·5-87·5 ... 2. *leschenaulti.*
> (*b*) Nape, and shoulders semi-naked; forearm 79-85·5 mm. ... ... 3. *seminudus.*

Anderson's[2] diagnosis reads:—'similar to *R. leschenaulti,* but p. [=premolar] deciduous, nape and shoulders semi-naked, . . . '. Referring to the skull the same authority writes, 'Size and shape of skull as in *R. leschenaulti.*' Mr. Phillips'[3] recorded measurements indicate no difference between those of *leschenaulti* and *seminudus.* The difference of the forearm measurements is very meagre indeed. The measurements of the specimens listed in this article from the Tulsi Lake tunnel, as shown below, are equal to or exceed all the measurements in the above key. As such the difference in forearm length is valueless as a means of differentiating between the two species. The second distinctive character upon which the species *seminudus* is established is 'nape and shoulders semi-naked'. That this semi-nakedness is a constant character is not borne out by specimens from Ceylon obtained by the Mammal Survey and identified at the British Museum by Wroughton himself (Specimens collected by E. W. Mayor Nos. 870, 881, 889, 919). Beyond the usual bareness behind the neck and between the scapulars, already referred to above in *leschenaulti,* there is no further nakedness. No. 919, an old male, is more thinly clad than the other three, over the dorsal surface. *R. leschenaulti* can be obtained in all possible stages of nudity and could accordingly be assigned to the 'species' *seminudus.* 'Gray's type is very probably one of these semi-naked examples which Gray assumed was a constant character. The nakedness, as I have pointed out, is frequent, and more prevalent among males, but what it is due to I am not prepared to state definitely, though I have suggested the possible causes. There is no apparent skin complaint.

Thus it is clear that *Rousettus seminudus* Gray must be regarded as a synonym of *R. leschenaulti* Desm. and that the Ceylon *Rousettus* is the same as the Indian and cannot be separated by the characters recorded by Gray.

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[1] *Journ. B.N.H.S.* xxv (1918) p. 565.
[2] *Cat. of Chirop.* B. M., p. 39.
[3] *Manual of the Mammals of Ceylon* (1935) p. 69.

ON THE FOOD-PLANTS OF INDIAN BOMBYCES (*HETEROCERA*).

BY

D. G. SEVASTOPULO, F.R.E.S.

The lack of knowledge of the early stages, etc. of our Indian Heterocera was brought home to me very forcibly recently. I had obtained a batch of fertile ova from a captive female of the very common Syntomid *Eressa confinis* Wlk. and wished to know what food to give to the newly hatched larvae. I therefore consulted my books but was unable to obtain the information I required. Butler and Hampson in Vols. v to ix of *Illustrations of Typical Specimens of Lepidoptera Heterocera in the Collection of the British Museum* do not mention a single Syntomid larva. Moore in *The Lepidoptera of Ceylon* figures and describes one species only, and this is quoted by Hampson in the *Fauna of British India—Moths.* Hampson in his *Catalogue of the Lepidoptera Phalaenae* mentions the larvae of two Oriental Syntomids only, the species described by Moore and referred to above and a closely allied Javanese species. Whilst Seitz in the *Indo-Australian Bombyces* mentions the same two species and adds a remark that the larvae of one genus live on low plants.

Species of economic importance are better known and much information can undoubtedly be found in the publications of the Forest Research Institute, Dehra Dun, of the Imperial Agricultural Research Institute, New Delhi, and of the Tea Research Institute, Tocklai, but neither these nor the many scattered papers of a non-economic nature are readily referred to by amateur entomologists in India.

The present paper is, therefore, an attempt to summarise such information as I have been able to find concerning the food-plants of Indian Bombyces, to add my own personal experiences and to make suggestions based on what is known about allied species in other countries. I have made no reference to the Sphingidae as this group is most adequately dealt with in Bell & Scott's *Sphingidae, Fauna of British India—Moths,* Vol. v.

My principal sources of information have been Moore's *Lepidoptera of Ceylon,* Seitz' *Indo-Australian Bombyces, Macrolepidoptera of the World,* Hampson's *Fauna of British India—Moths,* the same author's *Catalogue of the Lepidoptera Phalaenae* (Syntomidae and Arctiidae only) and Butler's and Hampson's *Illustrations of Typical Specimens of Lepidoptera in the Collection of the British Museum,* Vols. v to ix. These have been abbreviated in references to Lep. Ceyl., Seitz, Fauna, Lep. Phal. and Ill. Het. respectively.

I have followed Seitz in the arrangement of families,

CASTNIIDAE.

Nothing known.

ZYGAENIDAE.

Himantopterus Wesm.—It is suggested that the larvae of this genus have a relationship with Termites similar to that between Lycaenid larvae and Ants (Seitz).

Phauda Wlk.—Ficus and Terminalia (Seitz).

Callizygaena Hamps.

C. semperi Druce.—Myrmecylon tinctorium (Seitz). (non-Indian).

Trypanophora Koll.

T. semihyalina Koll.—Terminalia (Seitz), Lagerstroemia indica and L. flosreginae (mihi).

T. tabrobanes Wlk.—Lagerstroemia (Lep. Ceyl., Seitz).

T. javanica Snell.—Terminalia, Anacardium, Spondias, Mangifera, Eugenia, Rosa (Seitz). (non-Indian).

T. dissimilis Snell.—Cinnamonum (Seitz). (non-Indian).

T. luzonensis Semp.—Eugenia and Myrmecylon (Seitz). (non-Indian).

Cyclosia Hbn.—Larvae as far as known on Solanaceae and Aroideae (Seitz).

C. panthona Cr.—A. Lindleyana (Lep. Ceyl.).

C. macularia Guer.—Pierardia racemosa (Seitz). (non-Indian).

C. papilionaris Drury.—In Java on Solanum ardisioides (Seitz).

Pompelon Wlk.

P. marginata Guer.—Cinnamomum (Seitz).

Erasmia Hope.

E. pulchella Hope.—'Wild coffee' (Seitz), Hibiscus (mihi).

Eterusia Hope.—'at least partly, polyphagous on various plants, as tea, roses, Polygonum, etc.' (Seitz).

E. pulchella Koll.—Roses, tea, Polygonum (Seitz).

E. risa Dbl.—Symplocos and Thea (Seitz).

E. aedea L.—Tea and other plants (Seitz). ssp. *cingala* Moore—Lagerstroemia (Lep. Ceyl.) and tea (Seitz).

E. distincta Guer.—Jambosa densiflora and Melastoma polyantum (Seitz).

Chalcosia Hbn.

C. phalaenaria Guer.—Symplocos fasciculata (Seitz). (non-Indian).

Artona Wlk.—Larva found by Piepers on Bambusa and Cocos, as well as another plant not determined with certainty, which in Java is called Dawonoundjek (perhaps a species of Pittosporum or Caryodaphne). (Seitz).

Illiberis Wlk.—A Japanese species feeds on Pirus communis (Seitz).

Thyrassia Btlr.—Larva found by Piepers on Vitis (Seitz).

T. philippina Jord.—Cissus acida (Seitz). (non-Indian).

Epizygaena Jord.

E. cashmirensis Koll.—I have never bred this species but I strongly suspect that it feeds on Dodder.

EPICOPEIDAE.

Epicopeia Westw.

E. mencia Moore.—On an elm, which is designated by missionaries as the Chinese or small leaved elm (Seitz).

SYNTOMIDAE.

Syntomis O.—The larvae feed on low plants (Seitz).

Euchromia Hbn.

E. polymena L.—On Convolvulaceae (Lep. Ceyl., Lep. Phal.)

E. horsfieldi Moore.—Dioscoreae (Lep. Phal., Seitz). (non-Indian).

URANIIDAE.

Nothing mentioned about the food-plants.

ARCTIIDAE.

Nolinae.

The Fauna wrongly states that the larvae feed on Lichens.

Nola Leach.

N. argentalis Moore.—Castanopsis indica (Lep. Phal., Seitz).
N. cucullatella L.—Blackthorn, hawthorn, apple (Lep. Phal.). (non-Indian).

Roeselia Hbn.

R. nitida Hamps.—Ilex (Lep. Phal., Seitz).
R. lignifera Wlk.—Terminalia catappa (Seitz).
R. fola Swinh.—Quisqualis indica (mihi).
R. albula Den. & Schiff.—Rubus (Lep. Phal.). (non-Indian).
R. strigula Den. & Schiff.—Oak (Lep. Phal.). (non-Indian).

Celama Wlk.

C. fasciata Wlk.—Lantana camara (Seitz).

C. internella Wlk.—Internally in Rubus (Ill. Het., ix, Fauna, Lep. Phal., Seitz) and on Durio zibenthinus (Seitz).

C. taeniata Snell.—Fimbristylis miliacea (Seitz).
C. centonalis Hbn.—Trifolium, Lotus, etc. (Lep. Phal.). (non-Indian).
C. confusalis Herr.—Schaff.—Quercus, Pomus, etc. (Lep. Phal.).

Lithosiinae.

The larvae feed on Lichens (Lep. Phal., Seitz).

Stigmatophora Stgr.—Rock lichens (Seitz).

Asura Wlk.—Presumably without exception on lichens (Seitz).

A. lutara Moore.—Lichens on different trees (Seitz), Solanum indicum (Lep. Phal.).

A. semifascia Wlk.—Mosses (Lep. Ceyl., Ill. Het., ix, Lep. Phal., Seitz).
A. humilis Wlk.—Lichens (Seitz).

Asuridia Hamps.

A. ridibunda Snell.—Durio zibethinus (Seitz). (non-Indian).

Chionaema Herr.—Schaff.—Lichens (Seitz).

C. javanica Btlr.—Muscus (Lep. Phal.), moss (Seitz).
C. pitana Moore.—Mosses on wet walls (Seitz). (non-Indian).
C. bianca Wlk.—Mosses on trunks (Seitz).

Halone Wlk.

H. sinuata Wllgr.—Lichens on rocks (Lep. Phal.). (non-Indian).

Pseudoblabes Zell.

P. oophora Zell.—Mosses and Lichens (Seitz).

Oeonistis Hbn.

O. entella Cr.—Lichens (Ill. Het., ix, Lep. Phal., Seitz) and according to Piepers also on Flacourtia and Ficus heterophylla (Seitz).

Lithosia F.—Lichens (Seitz).

L. tumida Wlk.—Mosses (Seitz).
L. apicalis Wlk.—Moss and lichens, also on the leaves of Tamarindus and
L. eugenla (Seitz). (non-Indian).
L. natara Moore.—White lichens on Citrus (Seitz).
L. depressa Esp.—Lichens (Lep. Phal.). (non-Indian).
L. complana L.—Lichens (Lep. Phal.). (non-Indian).

L. sericea Gregson—Lichens, dead leaves (Lep. Phal.). (non-Indian).
L. lurideola Zink.—Quercus, Rhamnus, etc. (Lep. Phal.). (non-Indian).
L. griseola Hbn.—Lichens, dead leaves (Lep. Phal.). (non-Indian).
L. caniola Hbn.—Lichens, flowers of Lotus (Lep. Phal.). (non-Indian).
L. palliatella Scop.—Lichens (Lep. Phal.). (non-Indian).
L. lutarella L.—Saline lichens (Lep. Phal.). (non-Indian).
L. sororcula Hufn.—Lichens (Lep. Phal.). (non-Indian).

Tigrioides Btlr.

T. puncticollis Btlr.—Mosses (Seitz). (non-Indian).

Hypsinae.

Tree larvae (Seitz), in my opinion they would all eat Ficus spp.

Aganais Bsd.

A. ficus F.—Peepul (mihi).

Asota Hbn.

A. caricae Bsd.—Various trees (Seitz), Ficus oppositifolia (Lep. Ceyl., mihi).

Arctiinae.

Most species are polyphagous and will eat Compositae, Labiatae, Polygonaceae, etc.

Maenas Hbn.

M. maculifascia Wlk.—Convolvulus, Dioscorea oppositifolia and Erythrina (Lep. Phal., Seitz). (non-Indian).

Diacrisia Hbn.

D. rhodophila Wlk.—Cherry (Ill. Het., vii, Lep. Phal.).
D. urticae Esp.—Rumex, Mentha, etc. (Lep. Phal.). (non-Indian).
D. lubricipeda L.—Plantago, Mentha, Rumex, etc. (Lep. Phal.).
D. subfascia Wlk.—Mussaenda, Trema and other plants (Ill. Het., ix).
D. lutea L.—Rumex, Plantago, Mentha, etc. (Lep. Phal.). (non-Indian).
D. obliqua Wlk.—Geranium (Ill. Het., vii), Sunflower and Dahlia (mihi).
D. sannio L.—Hieraceum, Erica, Scabiosa, etc. (Lep. Phal.). (non-Indian).
D. strigatula Wlk.—Dioscorea oppositifolia, etc. (Lep. Phal., Seitz).
D. mendica Clerck.—Rumex, Myosotis, Plantago, etc. (Lep. Phal.). (non-Indian).

Amsacta Wlk.

A. lactinea Cr.—Menispermum glabrum (Lep. Phal.).
A. moorei Btlr.—Groundnuts (Lep. Phal.).

Creatonotus Hbn.

C. transiens Wlk.—Galing (? Cissus) (Lep. Phal.), Compositae (mihi).

Pericallia Hbn.

P. erosa Wlk.—Gloriosa superba (Lep. Ceyl., Lep. Phal.), Thunbergia (Lep. Phal.).
P. ricini F.—Notonia, Fagraea (Lep. Ceyl., Lep. Phal.), Dahlia (Lep. Ceyl., mihi), Castor and many low plants (mihi).

Euarctia Stgr.

E. proserpina Stgr.—Artemisia, Euphorbia (Lep. Phal.). (non-Indian).

Arctia Schrank.

A. caia L.—Urtica, Plantago, etc. (Lep. Phal.), also Dock, Lettuce, Dandelion, Virginia Creeper (mihi).
A. villica L.—Myosotis, Plantago, Rumex, Ulex, etc. (Lep. Phal.). (non-Indian).

Utetheisa Hbn.

U. pulchella L.—Myosotis, grasses, etc. (Lep. Phal.).
U. lotrix Cr.—Dahlia (mihi).

Rhodogastria Hbn.

R. astreus Drury—Beaumontia (Lep. Ceyl.).

Migoplastis Fldr.

M. alba Moore—Probably lichens (Ill. Het., ix).

Argina Hbn.

A. argus Koll.—Crotalaria (Lep. Ceyl.), an unknown Papilionaceous plant (mihi).
A. syringa Cr.—Crotalaria (Lep. Ceyl.).
A. cribraria Clerck—Low plants (Seitz).

Callimorphinae.

Callimorpha Latr.

C. principalis Koll.—Plantain (Ill. Het., vii), low plants (Seitz).

Nyctemerinae.

For the greatest part confined to plants of the genus Senecio (Seitz).

Nyctemera Hbn.—Senecio species (Seitz).

N. coleta Cr.—Gynura and other Compositae (Lep. Ceyl.).
N. plagifera Wlk.—Gynura sp. (mihi).

LYMANTRIIDAE.

Dasychira Steph.

D. dalbergiae Moore.—Dalbergia sissoo (Ill. Het., vii).
D. complicata Wlk.—Apple, Bracken, Montbretia, Lagerstroemia indica (mihi).
D. mendosa Hbn.—Citrus (Lep. Ceyl.), tea, cotton, Terminalia catappa, Ziziphus jujuba, Caesalpina sp. (Seitz). Mango and Lagerstroemia indica (mihi).
D. securis Hbn.—Grasses (Lep. Ceyl.).
D. horsfieldi Saund.—Tea (Seitz).
D. moerens Fldr.—Smilax and Vitis (Ill. Het., ix).
D. varia Wlk.—Leucosceptrum canum (Seitz).
D. thwaitesi Moore—Erythrina indica (Lep. Ceyl.).
D. bhana Moore.—Various plants (Seitz).
D. grotei Moore.—Rose and willow (Ill. Het., vii).
D. pudibunda L.—Oak and other trees. (non-Indian).

Orgyia O.

O. postica Wlk.—Caesalpinia (Lep. Ceyl.), Caesalpinia, almond and apple (Seitz), tea and Lagerstroemia indica (mihi).

Aroa Wlk.

A. leucogramma Fldr.—Bamboos (Seitz). (non-Indian).
A. ochracea Moore.—Bamboos (Seitz).

Laelia Steph.

L. suffusa Wlk.—Grasses (Seitz).
L. calamaria Hamps.—Calamus huegelianus (Seitz).

Leucoma Steph.

L. subvitrea Wlk.—Terminalia catappa (Seitz).
L. marginalis Wlk.—Mangifera and Terminalia sumatrana (Seitz). (non-Indian).
An unidentified species from Tea (mihi).

Thiacidas Wlk.

T. postica Wlk.—Zizyphus jujuba (Seitz).

Lymantria Hbn.

L. obfuscata Wlk.—Oak and hawthorn (Seitz).

L. obsoleta Wlk.—Eugenia sp., Ficus indicus (Seitz). Ficus religiosa (mihi).

L. incerta Wlk.—Acacia arabica (Seitz).

L. grandis Wlk.—Careya arborea, etc. (Lep. Ceyl.).

L. ampla Wlk.—Almost omnivorous (Lep. Ceyl.), Palms, Mango, Casaurina and Crotalaria (mihi).

L. lunata Stoll.—Diospyros sp., Eugenia sp., Psidium, Sesbania, Ricinus, 'Mauzanas de China' and Terminalia (Seitz). (non-Indian).

Cispia Wlk.

C. alba Moore.—Dysoxylon (Lep. Ceyl.).

Perina Wlk.—Fig trees (Seitz).

P. nuda F.—Acanthads (Lep. Ceyl.), Ficus religiosa and F. indica (Seitz), F. religiosa (mihi).

Porthesia Steph.

P. scintillans Wlk.—Wild Barberry (Ill. Het., vii), Coffee, tea, rose and various shrubs (Ill. Het., ix), Gynurus (Lep. Ceyl.), Sesbania and willow (Seitz), Lagerstroemia indica, Tamarisk, Sunflower (mihi). f. *limbata* Btlr.—Tea (mihi). f. *subnotata* Wlk.—Cycas circinalis, etc. (Lep. Ceyl.).

Euproctis Hbn.

E. bimaculata Wlk.—Acanthads (Lep. Ceyl.), polyphagous (Seitz).

E. fraterna Moore.—Coffee, tea, Rubus, Rosa and many other shrubs (Ill. Het., ix).

E. apicalis Wlk.—Various forest trees (Ill. Het., ix), Terminalia (Lep. Ceyl.).

E. guttata Wlk.—Lagerstroemia indica (mihi).

E. diplaga Hamps.—Schima wallichii (Seitz).

E. fulvipuncta Hamps.—Litzea zeylanica (Ill. Het., ix).

E. decussata Moore.—Loranthus (Lep. Ceyl.).

E. sulphurescens Moore.—Willow (Ill. Het., vii).

E. vitellina Koll.—Lotus corniculatus (Ill. Het., vii).

E. atrosquama Wlk.—Sesbania sp., Caesalpinia sp., Pithecolobium sp., Psidium sp., Bambusa sp. (Seitz). (non-Indian).

THAUMETOPOEIDAE.

A European member of the family is a pest on Pines and Firs.

RATARDIDAE.

Nothing known.

LASIOCAMPIDAE.

Lebeda Wlk.

L. nobilis Wlk.—Bracken, Pine, Rubus (mihi).

Suana Wlk.

S. concolor Wlk.—Careya arborea, etc. (Lep. Ceyl.).

Metanastria Hbn.

M. hyrtaca Cr.—Spiridium (Lep. Ceyl.), Mimusops elengi (mihi), Guazuma tomentosa, Terminalia catappa, Mimusops elengi, Nyctanthes arbor-tristis, Bassia longifolia, Schima wallichii, Eugenia jambolana, Acacia arabica, Albizzia stipulata and Anthocephalus morindaefolius (1938, Subramaniam and Anantanarayanan, *Journ. Bomb. Nat. Hist. Soc.*, xl, 262-3).

Chilena Wlk.

C. strigula Wlk.—Acacia-like thorn bushes (Seitz).

Malacosoma Hbn.

M. neustria L.—Prunus, Crataegus, Apple, etc. (non-Indian).

Trabala Wlk.

T. vishnu Lef.—Terminalia and Eugenia (Lep. Ceyl.), Ricinus, Rosa, Rubus, Quisqualis indica, Lagerstroemia flosreginae (mihi).

Lenodora Moore.

L. vittata Wlk.—Gramineae (Lep. Ceyl., Seitz).

Cosmotriche Hbn.

C. potatoria L.—Grasses. (non-Indian).

EUPTEROTIDAE.

Eupterote Hbn.

E. fabia Cr.—Different shrubs on road-sides (Seitz), Acanthads (Lep. Ceyl.)
E. mollifera Wlk.—Bushes on the road-sides (Seitz), Acanthads (Lep. Ceyl.).

BOMBYCIDAE.

The larvae seem to live exclusively on trees and frequently prefer cultivated trees (such as figs, mulberries). (Seitz).

Bombyx L.

B. mori L.—Mulberry.

Ocinara Wlk.

O. varians Wlk.—Artocarpus integrifolia (Lep. Ceyl.), Ficus religiosa (mihi).
O. dilectula Wlk.—Ficus sp. (Seitz). (non-Indian).
O. waringi Snell.—Ficus (benjamina?) (Seitz). (non-Indian).

Mustilia Wlk.

M. phaeopera Hamps.—Camellia caudata (Seitz).

Andraca Wlk.

A. albilunata Hamps.—Cudranus javanicus (Seitz).

DREPANIDAE.

Very little known about the Indian species. In Europe on Oak, Birch, Beech, Sallow etc.

Teldenia Moore.

T. vestigiata Btlr.—Eugenia firma (Lep. Ceyl.).

Drapetodes Guen.

D. fratercula Moore.—Cardamons and allied plants (Lep. Ceyl.).

CALLIDULIDAE.

Nothing known.

SATURNIIDAE.

Mostly polyphagous (Seitz).

Actias Leach—Juglans, Mango, Careya and many other shrubs (Seitz).
A. selene Hbn.—Odina Wodier (Lep. Ceyl.), Mango, Juglans, cherry, apple, willows and other foliage trees and ornamental bushes (Seitz), apple and willow (mihi).

Attacus L.

A. atlas L.—Berberidae, Simarubaceae, Cupuliferae, Salicineae, also Ailanthus glandulosa (Seitz). ssp. *taprobanis* Moore—Cinnamon and other trees (Lep. Ceyl.).

Samia Hbn.

S. cynthia Drury.—Ricinus, Ailanthus (Seitz, mihi), Lagerstroemia indica (mihi).

Loepa Moore.

L. katinka Westw.—Cissus and Leea, probably also vine (Seitz).

Cricula Wlk.

C. trifenestrata Helf.—Various trees such as Canarium commune, Mangifera and other Anacardiaceae such as Anacardium occidentale and orientale, as well as on species of Prunus (Seitz).

Antheraea Hbn.

A. paphia L.—Ficus, Gnidia, Terminalia, Ziziphus jujuba (Seitz). ssp. *cingalesa* Moore—Terminalia (Lep. Ceyl.).
A. knyvetti Hamps.—Wild cherry and birch (Fauna), wild cherry and other trees (Seitz).
A. roylei Moore.—Muhowah, oak, birch (Fauna), different foliage trees such as oak, birch and others (Seitz).
A. assamensis Westw.—Numerous species of trees and bushes (Seitz).

Dictyoploca Jord.

D. simla Westw.—Cocoons found commonly on Lagerstroemia indica (mihi).
D. cachara Moore.—Possibly Juglans regia (Seitz).

Eriogyna Jord.

E. pyretorum Westw.—Various foliage trees (Seitz).

BRAHMAEIDAE.

Brahmaea Wlk.

B. wallichii Gray.—Fraxinus macrocantha (1936, Graham, *Journ. Bomb. Nat. Hist. Soc.*, xxxviii, 594), Ligustrum robustum (1938, Scott, *Journ. Darj. Nat. Hist. Soc.*, xiii, 30).

EPIPLEMIDAE.

Epiplema Herr.—Schaff.

E. latifasciata Moore—Fagraea zeylanica (Lep. Ceyl.).
E. quadricaudata Wlk.—Cinchona (Lep. Ceyl.).

NOTODONTIDAE.

Dudusa Wlk.

D. nobilis Wlk.—Schleichera trijuga (1935, Bell, *Journ. Bomb. Nat. Hist. Soc.*, xxxviii, 136).

Nadata Wlk.

N. niveiceps Wlk.—Quercus sp. (mihi).

Phalera Hbn.

P. parivala Moore.—Lespedeza Thompsoni (mihi).
P. goniophora Hamps.—Quercus serrata (Seitz).

Turnaea Wlk.—Seitz suggests Monocotyledons, but I was unable to induce newly hatched larvae of *T. acuta* Wlk. to eat Grasses, Palms or Bamboo.

Norraca Moore.—Seitz suggests Monocotyledons.

Niganda Moore.—Seitz suggests Monocotyledons.

Pydna Wlk.—Seitz suggests Monocotyledons.

Dinara Wlk.—Seitz suggests Monocotyledons.

Antheua Wlk.—Seitz tentatively suggests Monocotyledons.

Stauropus Germ.
S. alternus Wlk.—Cassia fistula (Lep. Ceyl.).
S. sikkimensis Moore *berberisae* Moore.—Berberis and Wild Pear (Ill. Het., vii).
S. inclusa Hamps.—Quercus griffithii (Seitz).
S. diluta Hamps.—Ilex exsulca (Seitz).

Netria Wlk.
N. viridescens Wlk.—Sapotaceae (Lep. Ceyl.).

Desmeocraera Wllgrn.
D. fasciata Moore.—Quercus sp. (mihi).

Cerura Schrank.—The European species on Populus, Salix and Alnus.
C. kandyia Moore.—Salix (Lep. Ceyl.).

Dicranura Bsd.
D. vinula L.—Salix and Populus. (non-Indian).
D. himalayana Moore.—Willows (Ill. Het., vii, Seitz).

Neopheosia Mats.
N. fasciata Moore.—Cherry (Ill. Het., vii).

Pygaera O.
P. restitura Wlk.—Elaeocarpus (Lep. Ceyl.).

CYMATOPHORIDAE.

Thyatira Hbn.
T. batis L.—Raspberry (Ill. Het., vii), Rubus sp. (mihi).

LIMACODIDAE.

Polyphagous (Seitz).

Cheromettia Moore.
C. ferruginea Moore.—Coffee etc. (Lep. Ceyl.).
C. lohor Moore.—Coffee, Banana, Ricinus, Mango (Seitz). (non-Indian).

Nagoda Moore.
N. nigricans Moore.—Coffee (Lep. Ceyl., Seitz).

Narosa Wlk.
N. conspersa Wlk.—Coffee (Lep. Ceyl.).
N. doenia Moore.—Erythrina (Seitz).

Cania Wlk.
C. bilinea Wlk.—Banana, Cadamba and Guettarda (Seitz).

Altha Wlk.
A. adala Moore.—Bauhinia (Lep. Ceyl.), Anona and Bauhinia (Seitz).

Miresa Wlk.
M. bracteata Btlr.—Cinchona and Coffea (Seitz).
M. fulgida Wil.—Canarium album (Seitz). (non-Indian).
M. argentifera Wlk.—Musa (Lep. Ceyl., Seitz).
M. thermistis Hamps.—Bucklandia (Seitz).
M. brunnea Semper.—Cassia (Seitz). (non-Indian).

Chalcocelis Hamps.
C. albiguttata Snell.—Coffee and Erythrina (Seitz).

Chalcoscelides Her.
C. castaneipars Moore—Spondias and Trevesia (Seitz).

Scopelodes Westw.

S. venosa Wlk.—Polyphagous on coffee, rose, etc. (Lep. Ceyl., Seitz).
S. pallivittata Snell.—Musa sp. (Seitz).
S. unicolor Westw.—Eugenia, Phaseolus, Nephelium (Seitz).
S. ursina Btlr.—Diospyros (Seitz).

Parasa Moore.

P. lepida Cr.—Coffee and Tea (Ill. Het., ix, Lep. Ceyl.), polyphagous (Seitz), Mango and Gardenia (mihi).
P. bimaculata Snell.—Mangifera and Nephelium (Seitz). (non-Indian).
P. canangae Her.—Cananga odorata (Seitz).
P. bicolor Wlk.—Bamboo (Seitz).

Trichogyia Hamps.

T. semifascia Hamps.—Lagerstroemia and Coffea (Seitz). (non-Indian).

Euphlycta Snell.

E. erastria Snell.—Coffee (Seitz). (non-Indian).

Susica Wlk.

S. pannosa Snell.—Musa sp. (Seitz). (non-Indian).

Setora Wlk.

S. nitens Wlk.—Coffee, tea, banana etc. (Seitz).

Thosea Wlk.

T. loesa Moore.—A great number of cultivated plants (Seitz).
T. cervina Moore.—Polyphagous (Lep. Ceyl., Seitz).
T. cana Wlk.—Cassia auriculata, etc. (Lep. Ceyl.), Cassia, etc. (Seitz).
T. tripartita Moore.—Ricinus and other plants (Seitz).
T. bisura Moore.—Polyphagous (Seitz). (non-Indian).

Macroplectra Hamps.

M nararia Moore.—Lagerstroemia indica (mihi).
M. signata Moore.—Abutilon, Ficus, etc. (Lep. Ceyl.).

Oxyplax Hamps.

O. ochracea Moore.—Food various (Lep. Ceyl.), Apple (mihi).

Phocoderma Btlr.

P. velutina Koll.—Tung (C. M. Inglis in litt.).

EPIPYROPIDAE.

The larvae live on Homoptera (Psyllidae, Jassidae, Cicadae) and feed from their wax-secretions, though some species also seem to suck sweet saps. (Seitz).

PSYCHIDAE.

Pteroxys Hamps.

P. goniatus Hamps.—Zingiberaceae, grasses, etc. (Ill. Het., ix).

Mahasena Moore.

M. graminivora Hamps.—Grasses (Seitz).
M. theivora Dudg.—Tea (Seitz).

Chalioides Hamps.

C. vitrea Hamps.—Grewia hirsuta (mihi).

Amicta Heyl.

A. rhabdophora Hamps.—Tea and Cinchona (Ill. Het., ix).

Liothula Fer.

L. omnivora Fer.—Willows, conifers and many other plants (Seitz). (non-Indian).

Oiketicus Guilding.

O. tertius Templ.—Citrus decumana (Lep. Ceyl.).

Clania Wlk.

C. cramerii Westw.—Lagerstroemia indica, Alseodaphne semicarpifolia and many others (mihi).

C. destructor Dudg.—Tea (Seitz).

Amatissa Wlk.

A. consorta Templ.—Citrus decumana (Lep. Ceyl.).

A. cuprea Moore.—Banana (1938, Brahmachari, *Journ. Bomb. Nat. Hist. Soc.*, xl, 57).

THYRIDIDAE.

Dysodia Clem.

D. viridatrix Wlk.—Bores in wood (Fauna).

AEGERIIDAE.

Fleshy internal feeders on bark or pith (Fauna). Entirely endophyte. They partly live in wood, partly inside the stalks of plants, and are mostly monophagous or oligophagous. We know next to nothing about the early stages of the Indian and Australian species. As a number of elsewhere known larvae of Melittia live on Cucurbitaceae, it may be likely that also Indo-Australian members of this family are to be found on the stalks of such plants. A great many Aegeriid larvae live in hard wood, and some have been observed to be particularly fond of cancroid swellings of the bark, which may also be caused by them. (Seitz).

INDARBELIDAE.

Borers in wood (Fauna).

Indarbela Fletcher—A species is reported as damaging Ziziphus jujuba, Phyllanthus emblica, Bauhinia purpurea (Seitz).

I. quadrinotata Wlk.—Probably Bauhinia (mihi).

I. theivora Hamps.—Tea and Mango (Seitz).

I. campbelli Hamps.—Ochna squarrosa (Seitz).

I. dea Swinh.—Erythroxylum coca (Seitz).

COSSIDAE.

Wood of trees or stems of reeds (Lep. Ceyl.). Internal feeders, boring galleries in wood or the pith of reeds etc. (Fauna).

Zeuzera Latr.

Z. coffeae Nietn.—Coffee (Lep. Ceyl., Fauna).

Xyleutes Hbn.

X. nephocosma Trnr.—In the trunks of Melaleuca leucodendron (Seitz). (non-Indian).

X. nigra Moore.—In the root of the Coffee tree (Lep. Ceyl.), Coffee (Fauna, Seitz).

X. strix Cr.—In the wood of Agati grandiflora (Seitz).

X. kochi Semp.—In the wood of Gliricidia sp. (Seitz). (non-Indian).

Phragmataecia Newm.

P. castaneae Hbn.—In Europe in reeds.

HEPIALIDAE.

On the roots of plants (Lep. Ceyl.). Internal feeders in wood or the roots of grasses etc. (Fauna).

Phassus Wlk.—Borers in trunks of trees (Fauna).

Hepialiscsu Hamps.—Roots of grasses (Fauna).

A MAHSIR RIVER OF SOUTHERN INDIA.

BY

LIEUT.-COL. R. W. BURTON.

(*With a plate*).

The majority of visitors to the 'Blue Mountains' of Southern India see the Bhavani river at Mettupalaiyam, where it is spanned by road and rail and is a very ordinary looking stream of no particular attraction: yet, but a few miles up the valley, it is a rapid and beautiful river of many moods.

Those who come to the Hills from the direction of Mysore cross the largest tributary—the Moyar—which is, during some twenty miles of its course, one of the most inaccessible rivers in India, for it runs at the bottom of a tremendous ravine close upon a thousand feet deep known as 'The Mysore Ditch'. Apart from this natural obstacle the river there passes through forest country inhabited only by wild beasts and jungle tribes, and the steamy depths of the gorge are protected by a malaria said to be deadly even to the aboriginal people, who dare not remain on the river banks after sundown.

There are monster mahsir in those wonderful pools and deep runs, as has been discovered by a few adventurous sportsmen; but malaria—the most efficient and ever-watchful of all Game Wardens—preserves the wild beasts and the fish from the all-destroying hand of Man. To some extent the Bhavani is similarly protected for the first ten miles above Mettupalaiyam, but for twenty-five miles above that it is a lovely fishing river.

An affluent of the mighty Cauvery, the Bhavani joins that river at the town of Bhavani (another name for the Hindu Goddess Parvati, also known as Durga—The Earth Mother) which is twenty-four miles below the recently constructed Mettur Dam. This junction is some sixty miles below Mettupalaiyam and forty miles after the Moyar comes in on the left bank.

Through the writings of H. S. Thomas, whose work *The Rod in India* is as deserving of immortal fame as Izaac Walton's *Compleat Angler,* so charmingly is it written and so full of wise advice, this river is known to many by name; and the terrible reputation the lower gorge of the valley had sixty years ago for malaria obtains even to the present day. The fact is that along some twenty miles of the wider portion of the valley there is little malaria during the months of August and September, though all the usual protective precautions have to be taken for oneself and the camp followers, while the myriad mosquitos and other biting insects which greatly mar many a fishing trip are entirely absent.

Is there then no snag—apart from the many in the river—to this Angler's Paradise? There is—the necessity of enormous patience! At other times of the year the water is either too low or always in flood, but during these months mahsir are in all the pools and rapids. The fisherman must, however, have both time

A Mahsir River of South India.

Photo by — Bhavani Scenery : the Varagaar Pool. — Author.

Photo by — A 26lb. Mahsir. — Author.

at his disposal and the patience to wait, as there may be many spates during which no fish can be caught and the angler has to assume the role of *rusticus expectans.* On the occasion of his first visit the writer sat seven days in his tent *dum defluit amnis*, for heaven's flood-gates were open all the time. It is only one who is 'passing his pension days', as the Aryan brother expresses it, who can spare the time for such idle occupation.

Let us get to our furthest camp which is a mile beyond the Irula village of Seerakadavu. Here the river leaves the mountainous country which it has traversed from its sources on the southern slopes of the Kolaribetta Hill (8,624 ft. and only 26 ft. lower than Dodabetta, the highest point in the Nilgiris), and gathering to itself many streams well known to trout fishermen, descends through dense and malarious forests and a precipitous gorge to the village of Attapadi (The Abode of Leeches)—where it makes a left hand turn to shape a very direct north-easterly course for Mettupalaiyam. So it can be well realized why the South-West Monsoon occasions so many floods and freshets to the annoyance of the fisherman, though but little rain falls in the valley itself at that time of the year.

Within the angle above mentioned is the conspicuous hill named Malleswara (5,458 ft.), with its remarkable pinnacle having a 400 ft. perpendicular scarp, which dominates the whole valley and can be seen stabbing the sky from Mettupalaiyam. It is said that no man has ever set foot on the top of the pinnacle though it looks not too difficult of access by the eastern slope. On the opposite summit is a shrine visited by the Hindus of the country side during the month of August. It can be conceded to the perspiring pilgrims that they have indeed earned 'merit' as a reward for this toilsome journey, which no women are permitted to perform.

In the upper reaches above this camp the river narrows greatly, and as the fish mostly run small those waters should not be fished. Ordinarily one returns to the water all fish below about six pounds. A beginning is made with Camp Pool and Camp Run which empties the river into a long, deep, tree-bordered stretch of water. In Camp Pool are some bad snags. Several fine fish up to fifteen pounds have been taken from it; and one good one bored to the bottom, below the heavy water spilling into the pool, so boulders were heaved in to dislodge him. Suddenly *He's off*—(not the exact exclamation !)—and it was found that the steel link next to the bait had snapped. Probably one of the stones was too well aimed for otherwise this breakage, not taking place at the moment of seizure, is difficult to understand. The day before fish of seven and twelve pounds were killed, and the next day a heavy fish took a crocodile spinner in the deep pool and tore off one of the wire-mounted hooks. It is seldom artificial spinners are used for they often fail one and are more liable to catch in snags, whereas one treble hook, mounted on wire and used with a small dead bait as Thomas directs, has the least chance of mishap; and if properly adjusted the spin is more natural and effective.

That same day a fish with an edge to his appetite took the bait almost as it touched the water when popped over a rock; the wire trace was in twirls from the pull and the reel screamed. In August this year (1939) an unusually heavy fish for this part of the river was killed. Taking the bait—a four-inch fish—in shallow rapid water above a long, deep pool, he raced a full hundred yards before the coracle could be started after him; and another fifty yards before we were properly feeling him. Then all went rigid—not a move—and after some time it was realized that the line was hung up in some way. All that could be done was to reel in with rod top touching the water beneath overhanging branches, the coracle held by a man on the bank. Then the boatman dived with hand on line and found some fifteen feet down that it had passed under a projecting snag. The relief of mind when the line sprang to the surface! But we were not yet out of the wood, or the fish out of the water, for he was fifty yards further down and could not be felt; another snag. This time he was moved by rod work, and having been well rested did a hundred yards sprint to yet another snag. How well he knew all the safe anchorages! There he was soon dislodged, and after further down river cavortings was gaffed after a full hour at least five hundred yards from the start. Nose to tail-fork 43 in., girth 27 in., weight 41 lbs.; a fine cock fish; and the hook dropped from the roof of his mouth as he was laid on the ground!

In the remaining water from this camp, extending for a mile or more as far as Village Pool, fish have been taken on various trips the best being 18 lbs., and one or two certainly nearing the thirty-pound mark have escaped for one reason or another; it is mostly snag-like arguments which cause these lamentable partings.

Storms of the N.-E. monsoon along this river are very violent, as evidenced by the many charred and riven giant trees along the banks and lying in the pools and rapids. Occasionally there are heavy storms from the South-West. In the late afternoon of one 30th August when at this place—'Top Camp' I call it—the sky became overcast and thunder growled among the hills. The great sky-piercing tooth of Malleswara was lost to view and the hills changed from purple to pitch black. Soon the darkness deepened into night and the fireflies spangled the near-by bushes. Nearer and nearer came the storm, heralded by loud thunder claps and long flashes of vivid lightning. Now the thunder spoke in a long menacing growl and the incessant lightning disclosed a turmoil of leaping waters, for the rapid mountain torrents had already brought the river down in spate. The big trees lining the river banks swayed before the rushing wind, and in a few minutes the camp was flooded deep with torrential rain.

It had already been arranged to move camp down the valley in the morning so the coolies found the sodden tents rather more than they had bargained for; a small extra payment and gift of chewing tobacco heartened them for the nine mile march to Koorapati, which is a favourite camping place opposite where the Siruvani, joined a mile above by the Gopanari, comes in on the right bank. These rivers are a great nuisance. They drain a tea and coffee estate area so become turbid on the slightest excuse (an instance of the great denudation of soil caused by planting operations), so all the lovely length of the Bhavani from here to the Kundah River junction, ten miles down on the left bank, is often unfishable; and the Kundah carries on the bad work all the way to Mettupalaiyam.

The river being in spate we must switch off to another year. The coolies having been started off I get into the coracle to journey down the river, fishing all the best places on the way. Fish of ten to twenty pounds are usually found at certain known spots. One favourite place, where the Varagaar stream runs in on the left bank from its mountainous descent, has now been spoilt for many years by the fall of a forest giant which completely snags the incoming water. I doubt if it will ever be shifted. Leaving the Varagaar Pool, which ends a two-mile stretch of deep and mostly placid water, containing fish 'as big as bullocks' say the 'locals', the river becomes shallow and rapid for some two furlongs. In this length mahsir up to ten pounds may be expected and an occasional murrel: good eating, poor sport.

While the coracle is being taken down some turbulent water it may be given a few lines of description. It is rather wonderful what it can do. Being but six feet in diameter and fourteen inches deep yet it will safely ferry five men and several hundred pounds of baggage. The weight when dry is 45 lbs. and one man can carry it for miles without difficulty. Photographs of it in transit and in use are seen with 'Coracles and Chimpanzees' at page 116 of vol xli. The covering is of buffalo hide stretched over a basin-like basket of bamboo. There is but one seam, and the leather being kept in condition by applications of mustard oil lasts a long time. The resilience of construction admits of any amount of bumping over and against boulders, and any damage is easily repaired.

My fishing seat is a hinged-lid packing case 19 in. by 15 in. by 10 in. high, with padlock. A leather-covered cushion is necessary to soften the rigours of the box, or what naturalists call 'ischial callosities' will result. Fish up to 15 lbs. or so—two of them—go into the box; more, or bigger, stay outside. The whole affair—coracle and seat—costs twenty rupees: if one goes to another river the framework is left behind and a new one quickly made at the next camp. Hire of coracle, boatman, cooly, and boy to cook their rice is less than three rupees a day.

On arrival at Koorapati camp the tents are found pitched and breakfast ready. Let us have a look at our surroundings. The valley is very green just now, and along the length of it are the beautiful Nilgiri Hills down the slopes of which the footpath brought us over 3,000 feet in three miles, from a temperate climate to a more than warm one. The inhabitants of the valley are Irulas, an aboriginal people now busily ploughing their stony fields for sowing the ragi crop. In the group photograph the type of the people is seen. They are small in stature and very dark skinned; their noses are broad, and the people of this tribe are so like the Kurumbars that they can with difficulty be told apart. The men wear a top-knot, and the women wear their upper cloths stretched straight across the breast and passed under the arms. Their ornaments are brass bangles and necklaces of beads, so the similar goods from Woolworth's presented by me from time to time have been met with broad smiles. The numerous children appreciate scrambles for pice.

The Irulas will not eat beef. Each village has its cemetery, the dead being buried in a sitting position with the legs crossed tailor fashion. A lamp, knife, and hatchet are placed beside the body. The huts the people live in are but little different to those they run up in a few hours for the visiting sportsman and his servants. Their physical condition is poor, and it is curious that they should remain in this primitive condition within but a short distance of motor traffic and the civilization of Mettupalaiyam.

Except along the river banks, which are fringed by large evergreen trees, the jungle of the level country and the lower slopes of the hills is thorny, abounding with cactus and several species of euphorbia. Snakes are numerous. The wife of a river watcher was bitten by a viper a while ago, but happily recovered. It was a small snake, the husband said, so more than likely *echis carinata* was the culprit, for there was internal hæmorrhage a few hours after the bite and the local symptoms were very severe. The woman was in a great fright as there had been several deaths in the valley from snake-bite.

On the right bank of the river there is Government Forest which contains a few animals and some jungle fowl. One hears no sounds at night so the few tigers must live on cattle. This side of the river the Irulas have killed off everything and now complain of having no meat! A tigress killed a cow about three hundred yards from my tent at this camp on one occasion, but being an inexperienced young female did not make a neat job of it so the bellowing protestations of the poor cow brought shouting villagers to the scene and the beast went off without her dinner.

Now that the storm has ceased the sun is drying up the earth almost as fast as it was saturated by the rain. Those exquisitely coloured insects, with soft plush-like oval bodies about the size of a small cherry stone but more flat, are making their appearance. Soon they will lie about so thickly in places that they will redden the earth. Touch one and it will remain quiescent, a method of self-protection common to many things which creep and crawl. Brilliant butterflies are again flying about and one wonders how they escape damage during such boisterous weather; some indeed are bedraggled, and some have bits of wings clipped out by pursuing birds, but many are intact. Dragonflies and other insects hawk the rain-washed air; the song of birds is among the trees; hawks and vultures circle in the sky; all nature is smiling, which means that everything is more than ever busy eating everything else!

The river being again fishable an hour's walk takes me to 'Top Pool' by half-past eight to begin fishing by nine o'clock. Three four-inch fish from the bait-can are carefully mounted and the spin of each tested along the water's edge. Long practice makes perfect, and it is but seldom the spin is not satisfactory.

The bait must spin quickly for, as Izaac Walton wrote some 280 years ago in regard to spinning minnows for trout; '. . . try how it will turn, by drawing it across the water or against the stream, and if it do not turn nimbly, then turn the tail a little to the right or left hand, and try again, till it turn quick; for if not, you are in danger to catch nothing; for know, that it is impossible that it should turn too quick.' I make sure that the spin 'remains put' by means of sundry sewings with strong thread, white or khaki it matters not, and the coracle is quietly paddled to where the Varagaar rapids come in with a pleasing turmoil.

Away the bait goes with a Hillman bullet of suitable weight to keep it well down, and the cast being across and a little up stream it sinks to somewhere near the floor of the river and swings round with the current. Again and again this is repeated, the coracle quietly drifting, until a cast into the very edge of the current swirling along the steep, tree-rooted bank on the further side results in a furious tug, and that thrilling scream of the reel denoting a heavy fish. The tail of the pool is a full hundred and fifty yards away and he stops some eighty yards short of that, thus leaving that most promising place undisturbed. The first run safely completed the fish is humoured by steady strain to work up stream a bit, and so by degrees, after several other long or short runs and sundry shakings of head, is gradually tired out. Soon we see a surface swirl; there are tugs and short excursions which must not be too strenuously resisted; the coracle is beached against the sandy shore, the gaff made ready, and after some twenty minutes of play a fine hen mahsir of twenty-two pounds, is safely laid on the bank. A lovely fish; mahsir are a never ceasing source of delight to the eye and the mind of the fisherman in the East.

Again we set out, but this is on another day in another year, and at the tail of the pool where the escaping water divides either side of a *jāmun* bush the questing bait is taken by a heavy fish. The coracle is committed to the pull of the left channel and the fish prefers the right! Quick work with the rod takes the line sliding over the bending twigs of the first bush but the fish is too fast to permit of similar escape from one a few yards below, so coracle and fish race down the rapid water, the latter an easy winner.

Obviously the coracle must be swung to a halt against the left hand boulders and bushes as soon as possible, which is some eighty yards from the start; while the fish is quietly resting in the deep water of the pool a hundred and twenty yards from where hooked: the line is held taut by the twigs and the fish can have fifty more yards of line if he wants it, so all is well—perhaps! Two men, a fish watcher and the coracle cooly, have a difficult arm-clasping-arm crossing through the strong water of the run and make a diving plunge at the last moment to seize a saving branch. Soon the line is passed over the bending twigs and a furious winding in finds the fish still on; it puts up a stubborn fight in the strong water but is eventually tired out and brought to the sandy bank beneath the giant trees where he soon showed his broad bullock-like back and bright red fins. A deep and heavy fish of thirty pounds. Such happenings as this almost bring on a heart attack! It was noted on that occasion that a multiplying reel must be the next purchase.

After this pool—I call it Lower Pool—there is a most promising run into a long, deep stretch of water—Halcyon Pool—but only once have I taken a fish in it and that only six pounds. Then, after another portage, comes Mug's Pool, so named because there has so often been an easily taken seven-pound fish at that junction of two channels of the river. Then down a heavy rapid to Falls Pool which is formed by a rocky barrier across the river. It is at the tail of this, where it narrows towards the left bank, that one always expects a good fish. These come up Grandfather's Run from the deep pool below to lie on the sandy floor and feed on whatever the strong stream may bring down. When the river is 'just right' it is with confident expectation that the bait is sent to search out every yard of that lie. Fish of twenty to twenty-seven pounds have been hooked there many times, and all have to be followed in the dancing coracle to the pool for to attempt otherwise spells certain disaster. Where the long and turbulent run ends big fish may also be expected.

Now comes a lengthy portage—except when the river is high and a heavy rapid with three feet waves is negotiated—taking one to Temple Pool (a small, primitive jungle shrine in among the lofty trees) and fish not above fourteen pounds; below that a pool where a fish of eighteen pounds was taken on the first trip nine years ago (no other at that place since then at that seemingly excellent lie), and so down runs and rapids and long still pools in all of which a few fish have been caught from time to time, but only parts of it really good water, to Koorapati Camp.

In the intervals of searching the more likely places with the spinning bait there is much of interest to be observed and charm of scenery to delight the eye as the coracle moves down this lovely river. There are long, deep pools shaded to the water's edge by evergreen trees within the shadows of which are widening rings and splashes of surface-feeding fish; amidst the foliage birds and monkeys are descried, and sometimes a large maroon and buff squirrel is detected through the dropping of a fruit from the topmost branches of a giant tree; pied hornbills pass over with peculiar undulating flight; kingfishers of three varieties are perched or hovering; a snake-necked darter rises spattering from the water; a fish eagle is perched on the bare out-stretched branch of a tree; a disporting school of otters may be seen, and at certain known places a crocodile is looked for.

Fitful air movements run light wrinkles over the water, while an occasional puff of wind causes a flash of darkness to sweep across the placid surface. Looking upstream the vista of the wide waterway framed by the forest trees is backed by the dark green of the streaming ravines set off by the grassy or jungle-clad slopes of the billowing hills. Sometimes all is clear and detailed to the sight, then a turn of the river affords a distant view where the receding hills are clothed in a tint of the finest purple. The delicate blue surface of the water reflects the azure of the sky; each turn of the river discloses an ever-changing scene and over all is a feeling of perfect peace. Yet all the while one is sensible of that tragic world which lies beneath the surface of the waters, where there is no thought of mercy for any living thing which can neither fight nor flee. Nature, while smiling and beautiful to the human eye, is full of horror based upon the killing of things, sometimes with great cruelty, and seemingly with infinite futility and wantonness, as is instanced by the immense destruction of fishes eggs and small fry; but nature does not ruthlessly exterminate as does the ever destroying hand of man. Some thirty years ago this river was almost entirely denuded of fish life. Only the provision of fish watchers by the Government has restored it to something approaching what it should contain.

After this long discursion we set off at three thirty—the Siruvani being almost clear—to fish the very excellent downstream runs and rapids which have produced many fine fish. Close below camp is a good place denied to me for the past nine years by many snags; it may perhaps never be fishable, so firmly are the great trunks and branches interlocked. Then comes a long, narrow channel in which I have taken fish from ten pounds to fifty pounds. At the tail-end, where the heavy run curls over to break into boisterous waves is the place where hope runs high. In 1935 eleven fish were taken from that channel, the best being 51 lbs. (45 in. to tail-fork, 29 in. girth). That fish was unfortunate for he was held by only one strand of the three-ply wire trace and the points of the hook had not penetrated beyond the barb. There were many anxious moments during the hour of play, and it was late in the evening when the photograph was taken.

The spinning rod on that occasion was a 10 ft. 6 in. greenheart; for parts of the river where fish below fifteen pounds are expected a 7 ft. rod is suitable.

Below the channel is a mile of good water where fish are always found (Siruvani permitting) which ends in a deep pool where big fish lie. From here to Sundapati is four miles of pools, runs, rapids, and shallows but no fish over fifteen pounds have been found in it.

To travel fast downstream is a great delight. There is the shallow transparent water where the always beautiful mosaic floor of the river rises to the eye. Every pebble, every tiny fish, can be clearly seen. Now comes the increasing speed of the water sliding into the turmoil of the rapidly descending torrent; the rushing sound of the wave-tossed rapid; the deep growl of the angry waves obstructed by a boulder, and the exhilaration of a slight element of danger as the dancing coracle is dexterously twirled to pass the peril of a surface-breaking rock: then, shooting down at a speed which is faster than the stream itself, descent is made into the long reach of waves and eddies merging into sullen swirls like richly watered silk as the chastened stream mingles with the placid waters of the next long pool.

These entrances and exits of the pools are where the big ones lie; but unless the harbouring pool is really deep no fish of size will be found, for the mahsir likes his rest in the intervals of feeding excursions to be wholly undisturbed by surface happenings.

At Sundapati is some deep and heavy water and a splendid outgoing run some fifty yards wide yet, for some reason unknown, it is seldom one gets fish there. That there are some is certain, but those great-grandfathers do not come to the spinning bait: too lazy perhaps. In 1900 a Colonel MacArthur fished the previously baited pool with ragi paste on his large hook and killed a mahsir of 92 lbs. which was much admired and appreciated by Boer Prisoners of War in camp near Wellington. The late Mr. Mark Clementson of Ootacamund killed fish of between sixty and seventy pounds in the same pool by the same style of fishing, which is the method by which all the hundred-pound mahsir one hears of from Mysore waters of the Cauvery and Cubbany rivers are taken. Heave afar a large lump of ragi paste and sit expectant while the mosquitos eat you and the fish eats the paste! Good enough when coracle and spinning rod, or fly rod, sport is not possible.

It is after a week or more at Koorapati that one moves down to Sundapati, from where about three miles up and down stream can be fished. Possibly the sport here would be better in the warmer months of January and February. Certainly there would be good fun with the fly rod, for Carnatic carp run to ten pounds, and there are numerous other fly-takers also.

Sometimes, when the weather during August-September has been warmer than usual, I have had good sport with the fly rod in the long, still pools. The coracle is quietly floated down the centre of the stream and casts made under the shadowing trees and close to the steep banks. When the flying white ants emerge in their countless thousands many of them fall into the river to be gulped down by the ravenous fish, for the water will boil with rises when this luscious feast is served. A fly to imitate this insect has recently been put on the market with the name of 'Gibby's Ant', and is excellent for use at that time. For ordinary times there is a variety of flies—mostly dark ones; and a small green caterpillar on a worm tackle, the hooks considerably stronger than those used for trout, is very effective. The rod should be about ten to eleven feet in length, and casts of suitable strength.

Six miles below Sundapati is the Kundah river junction, and for almost a mile before that there is good water holding big fish. The Kundah has its sources in the high hills and comes in by many shallow channels, while below is a deep, rocky run bare of trees and vegetation where there are at times big mahsir difficult to entice to a spinning bait. I have seldom fished there.

Now the river descends steeply in a series of roaring rapids, cascades and waterfalls, quite impossible for the coracle, into the deep malarious gorge mentioned early in this article. I do not know if anyone has really fished there. It would be very exhausting and difficult work in those steamy depths and safe foot gear would be very necessary. I have just come across the perfect boot for slippery rocks, whether these be under or out of the water. They are made of rubber uppers and soles of compressed felt. Perhaps I may some day essay that gorge and if so the *Journal* shall have news of it.

At the foot of the gorge is fishable water which can be got at from Tekampati situated two miles by bridle path from the river bank. *Rod in India* should be read as to this part of the river; 'fish as big as portmanteaus', wrote Thomas. Arrangements from Mettupalaiyam, six miles distant, would present no difficulty. There is a motorable track.

Now the reader has been conducted from the top of the valley to rail head and nothing remains but to wish the intending sportsman the best of luck, which includes good weather and 'tight lines'.

THE MEDICINAL AND POISONOUS COMPOSITES OF INDIA.

BY

J. F. CAIUS, S.J., F.L.S.

COMPOSITAE

PART II

(Continued from page 645 of this volume).

ELEPHANTOPUS.

The genus consists of 20 tropical species, mostly American.

Elephantopus scaber Linn. is found throughout India. It is distributed over tropical Asia, Australia, and America.

The plant is an Ayurvedic and Yunani drug.

In Travancore a decoction of the roots and leaves is given in dysuria; the bruised leaves with rice are given internally for swellings or pains in the stomach.

In Chota Nagpur a preparation from the root is given for fever.

The Mundas use the roots as a remedy in diseases believed to be caused by a spell.

The plant is much used as a diuretic in Indo-China, as a diuretic and febrifuge in Madagascar, and as a vulnerary in Jamaica.

In the French Islands of the West Indies the herb is considered tonic, diaphoretic, and emmenagogue. The warm infusion is given in dyspepsia, intermittent fevers, loss of appetite, and menstrual derangements due to colds.

The herb is used in Brazil as an emollient and discutient in the form of a decoction or a poultice. A decoction of the root is prescribed in asthenic fevers.

Arabic: Kibnaite—; *Bengal*: Dadishaka, Gajialata, Gojialata, Samdulam, Shamdulum—; *Betsileo*: Tambakombako—; *Bombay*: Hastipata, Mhaka, Pathri—; *Brazil*: Fumo bravo—; *Burma*: Katoopin, Matoopin—; *Canarese*: Hakkarike—; *Ceylon*: Anichchovadi—; *Chanda*: Kaliagangawan—; *English*: Blue Elephant's-foot, Prickly-leaved Elephant's Foot—; *French*: Lastron marron, Pied d' éléphant—; *Gujerati*: Bhopathari, Kharsatbhopatri—; *Hindi*: Gobhi, Samdulam—; *Indo-China*: Chi thien—; *Jashpur*: Murgichundi, Talmuli—; *La Reunion*: Tabac marron—; *Malaya*: Tee tam tou, Ti tan, Tutup bumi—; *Malayalam*: Anashovadi—; *Marathi*: Gojibha, Pathari—; *Matheran*: Jirao, Junglijira, Lapoti—; *Mauritius*: Herbe la jouissance, Lastron marron, Libéralis—; *Mundari*: Maracuta—; *Persian*: Kalam-e-roomi—; *Porto Rico*: Lengua de vaca—; *Rio de Janeiro*: Erva do collegio—; *Sanskrit*: Adhomukha, Anadujivha, Darvi, Darvika, Darvipatrika, Gobhi, Gojivha, Gojivhika, Hdhapushpi, Kharapatri, Kurasa, Satamulika, Vatona—; *Santali*: Manjurjuti—; *Sinhalese*: Ataddeya, Etadi—; *Tagalog*: Tabatabacahan—; *Tamil*: Anashovadi—; *Telugu*: Eddumalikechettu, Enugabira, Hastikasaka—; *Tupi*: Suçuaya—; *Urdu*: Gobhi—.

EMILIA.

The genus consists of 5 palaeotropical species.

E. sonchifolia DC. is used medicinally in India, Indo-China, Gold Coast, La Reunion—; *E. flammea* Cass. in Lagos—; *E. sagittata* DC. in Lagos, Nigeria and Sierra Leone—; *E. adscendens* DC. and *E. graminea* DC. are used in Madagascar.

Involucral bracts much shorter than the scarlet flowers	... 1. *E. flammea.*
Involucral bracts about equalling the purple flowers	... 2. *E. sonchifolia.*

1. **Emilia flammea** Cass. is found in the Konkan. It occurs in the Philippine Islands, Lagos, Angola, Zanzibar.

It is used medicinally for children in Lagos.

Lagos: Aro agbe, Odundun odo—.

2. **Emilia sonchifolia** DC. is a common tropical weed found everywhere in India from the Punjab to Tenasserim and Ceylon, ascending to 4,000 ft. in the hills. It is common in waste ground and road sides over the whole Malay Peninsula, and over most of the tropical and subtropical regions.

In Malabar a decoction of the plant is said to be a febrifuge. Mixed with sugar it is given in bowel complaints.

In Travancore, pure juice of the leaves is poured drop by drop into the eyes in night-blindness. The natives consider the juice as cooling as rose-water and prescribe it in eye inflammations.

In Gold Coast the leaves mixed with Guinea grains and lime juice are a remedy for sore-throat.

In Indo-China a decoction of the leaves is prescribed as an antipyretic.

In La Reunion the plant is used as an astringent, antiasthmatic, and vulnerary.

Arabic: Oud el karah, Saela—; *Ashanti*: Guakuro—; *Bengal*: Sadimodi—; *Bombay*: Sadhimandhi—; *Canton*: Hong Pei Ts'ao—; *Cawnpore*: Hiranakhuri—; *Central India*: Hiranakhuri—; *Ceylon*: Kadupara—; *Indo-China*: Chua le, Chu le, Hen so, Hoa mat loi, La mat gioi, Mat gioi, Mat trang, Reang tuk, Tam toc, Tiet ga—; *La Reunion*: Goutte de sang, Lastron bâtard, Petit lastron—; *Malaya*: Katumbit jantan, Satumbak merah—; *Malayalam*: Mulshevi—; *Mende*: Gipoi, Kipoi—; *Mundari*: Kulaeara, Kulaebasu, Pirimaniare—; *Pampangan*: Tagulinao—; *Tagalog*: Tagulinao—; *Visayan*: Libun—.

ENHYDRA.

The genus consists of 9 tropical and subtropical species.

Enhydra fluctuans Lour. occurs in Eastern Bengal, Assam, Sylhet, and the Malay Peninsula. It extends to Sumatra, the Malay Islands, and China.

The leaves of this aquatic plant are regarded as laxative and useful in diseases of the skin and nervous system. The fresh juice of the leaves, in doses of about a tola, is prescribed by some kavirajas in Calcutta, as an adjunct to tonic metallic medicines, given in neuralgia and other nervous diseases.

The leaves are antibilious. The expressed juice of the leaves is used as demulcent in cases of gonorrhoea; it is taken mixed with milk, either of cow or goat. The leaves are pounded and made into a paste which is applied cold over the head as a cooling agent.

The Chinese prescribe the plant for torpidity of the liver.

Bengal: Hingcha, Hingeha—; *Hindi*: Harhuch, Haruch—; *Malaya*: Chinkro—; *Sanskrit*: Achari, Bramhi, Chakrangi, Helanchi, Hilamochi, Hilamochika, Jalabramhi, Mambi, Matsyakshi, Matsyangi, Mochi, Rochi, Shankhadhara, Trinittaparni, Vishaghni—.

ERIGERON.

The genus includes 180 cosmopolitan species, mostly North American.

The following species are used medicinally: in Indo-China—*E. aegyptiacus* Linn.—; in North America—*E. annuus* Pers., *E. canadensis* Linn., *E. philadelphicus* Linn.—; in La Reunion—*E. canadensis* Linn.—.

Heads $\frac{1}{4}$-$\frac{1}{2}$ in. diameter. Ligules bluish violet longer than the involucral bracts	1. *E. asteroides.*
Heads $\frac{1}{6}$-$\frac{1}{4}$ in. diameter. Ligules pale rose or purplish, scarcely exceeding the pappus	2. *E. canadensis.*

1. **Erigeron asteroides** Roxb. is found throughout India and Ceylon, up to 4,000 ft. in Sikkim.

The plant is a stimulant and diuretic, and is given in febrile conditions.

Bombay: Maredi, Sonsali—.

2. **Erigeron canadensis** Linn. is believed to be indigenous in North America. It occurs in all warm countries. In India it is found in the Upper Gangetic Plain, the Punjab Plain and the Western Himalaya where it ascends up to 3,000 ft.

According to the Ayurvedists the plant is styptic, diuretic, and astringent to the bowels.

The herb is used in America as a stimulant, astringent, and haemostatic. It has been found a useful remedy in the treatment of diarrhoea, dysentery, and dropsy. The oil is used in venereal diseases; it has been reported useful as a urinary and pulmonary haemostatic.

English: Cobbler's Pegs, Canada Fleabane, Squaw-weed—; *French*: Vergerette de Canada, Vergerolle—; *Iraq*: Dhail-as-saba'—; *Italian*: Impia—; *La Reunion*: Fausse camomille—; *Pacific Coast*: Fleabane, Horse-weed—; *Sanskrit*: Jarayupriya, Makshikavisha, Palita—.

ETHULIA.

The genus consists of 6 species spread over Asia, Africa, and South America.

Ethulia conyzoides Linn. is found in Eastern Bengal, Assam, and Sylhet. It extends to the Sunda Archipelago, Madagascar, and tropical Africa.

In Liberia the juice is squeezed into the eyes for headache; the root along with red pepper is given by enema for constipation; the leaves are eaten by pregnant women to prevent abortion; for pelvic pain a hot decoction of the leaves with those of *Baphia* is poured on the ground and covered with a mat on which the patient sits.

The Zulus use the plant as a remedy for intestinal parasites, for abdominal disorders, and for colic.

An infusion of the plant is used in Madagascar for dysentery, haemoptysis, and bruises. The pounded leaves are applied over sprains and fractures; the boiled leaves are used for wounds and traumatic haemorrhage.

In combination with other plants this herb is used to poultice phagedenic chancres and to wash purulent ulcers. The Betsileo use it in the treatment of scabies.

Betsileo: Tsimandra—; *Hova*: Homandra, Tangentsahona—; *Madagascar*: Kelihomandra—; *Mano*: Suo longo lah—; *Zulu*: umSokosoko—.

EUPATORIUM.

The genus includes 450 species, mostly American; a few in Europe, Asia, and tropical Africa.

The following species are used medicinally in Europe—*E. cannabinum* Linn., *E. perfoliatum* Linn.—; in China—*E. chinense* Linn., *E. japonicum* Thunb.—; in Indo-China—*E. cannabinum* Linn., *E. stoechadosmum* Hance, *E. triplinerve* Vahl—; in Malaya —*E. japonicum* Thunb.—; in the Philippine Islands, La Reunion, Mauritius, the West Indies—*E. triplinerve* Vahl—; in Jamaica; *E. nervosum* Sw., *E. villosum* Sw.—; in North America—*E. ageratoides* Linn., *E. aromaticum* Linn., *E. incarnatum* Walt., *E. perfoliatum* Linn., *E. purpureum* Linn., *E. teucrifolium* Willd.—; in Mexico—*E. collinum* DC.—; in Central America and Guiana—*E. parviflorum* Sw.—; in Brazil, South America, Madagascar—*E. triplinerve* Vahl—; in Ecuador—*E. glutinosum* Lam.—; in Colombia—*E. aromatisans* DC., *E. scabrum* Linn.—.

Pubescent. Flowers nearly white ...	... 1. *E. cannabinum.*
Glabrous. Flowers slaty blue ...	... 2. *E. triplinerve.*

1. **Eupatorium cannabinum** Linn. is found in the temperate Himalaya at 3,000 ft. ascending up to 11,000 ft., in the Khasia Hills between 3,000 and 6,000 ft., and in Burma. It is spread over temperate Asia and Europe.

An infusion of a handful of the fresh herb acts as a strong purgative and emetic, and is excellent for fomenting ulcers and putrid sores.

The herb is a good wound herb, whether bruised or made into an ointment with lard. In Holland the peasants use it for jaundice with swollen feet, and also give it as an alterative or purifier of the blood in the spring and against scurvy.

Herbalists recognize its cathartic, diuretic, and antiscorbutic properties, and consider it a good remedy for purifying the blood, either used by itself, or in combination with other herbs. A homoeopathic tincture is prepared, given in frequent small well-diluted doses with water, for influenza or a similar feverish chill.

A tea made with boiling water poured on the dry leaves will give prompt relief if taken hot at the onset of a bilious catarrh or of influenza. The infusion is a valuable tonic.

The freshly gathered root, boiled in ale, purges briskly, but without producing any bad effects; it is to this day a popular remedy for dropsy.

The herb is used as an emmenagogue and a purgative in Indo-China.

Bombay : Bundar—; *Catalan* : Canabassa, Lladrecá—; *Dutch* : Boeiskenkruid, Koninginnekruid—; *English* : Hemp Agrimony, Holy Rope, St. John's Herb—; *French* : Chanvrin, Eupatoire, Eupatoire d'Avicenne, Eupatoire à feuilles de chanvre, Eupatoire chanvrine, Eupatoire commun, Eupatoire de Mésué, Herbe julienne, Herbe de sainte Cunégonde, Origan aquatique, Origan des marais, Pantagruelion—; *German* : Kunigundenkraut, Wasserdost, Wasserhanf—; *Indo-China* : Bach son, Thach lam—; *Italian* : Canapa acquatica, Eupatorio, Eupatorio di Avicenna—; *Malta* : Hemp Weed, Water Agrimony, Canapa acquatica—; *Roumanian* : Canipioala—; *Spanish* : Cannabina de agua, Cañamazo, Cañamo silvestre acuatico, Eupatorio, Eupatorio de los Arabes, Eupatorio de Avicenna, Yerba del angel—; *Swedish* : Floks—.

2. **Eupatorium triplinerve** Vahl is a native of America, planted in Indian gardens.

Ayapanà may be compared with chamomile in its effects; it is stimulant and tonic in small doses, and laxative when taken in quantity; the hot infusion is emetic and diaphoretic, and may be given with advantage in the cold stage of ague and in the state of depression which precedes acute inflammatory affections.

An infusion of the whole plant is used as a stimulant, diaphoretic, and tonic in the Philippine Islands, Mauritius, La Reunion, and Madagascar.

The decoction of the plant and the juice of the leaves are considered detergent and applied to foul ulcers in the Philippines.

An infusion of the leaves is given in Indo-China and Guiana as an alexipharmic and a sudorific.

The herb is a snake remedy in Guiana, Brazil, the Philippine Islands, and India. The whole plant is given in the form of a decoction, and the juice of the leaves is given internally and applied externally to the part bitten. But Mhaskar and Caius have experimentally shown that the plant is useless in the symptomatic treatment of snake bite, and that the leaves are useless whether given internally or applied externally to the part bitten.

Annam : Cay bach son, La da yot, Trach lam, Trach lam diep—; *Bengal* : Ayapana—; *Betsimisaraka* : Ayapana—; *Brazil* : Ayapana—; *Ceylon* : Ayapeni—; *Cochin China* : La ba giot—; *English* : Ayapana Tea—; *French* : Ayapana vrai—; *Gujerati* : Alleppa—; *Indo-China* : Ba dot, Ca dot—; *Marathi* : Ayapana—; *Mauritius* : Ayapana—; *Sinhalese* : Ayiyapana—; *Spanish* : Ayapana—; *Tagalog* : Apana, Ayapana—; *Telugu* : Ayapani—.

GERBERA.

The genus numbers about 40 species, temperate or mountain herbs inhabiting Asia and Africa.

Gerbera piloselloides Cass. is found in the Central and Eastern Himalaya, ascending to 7,000 ft. in Sikkim and Nepal. It occurs in the Khasia Hills at 5,000 ft., and in the Karen Hills of Lower Burma. It extends to China and South Africa.

The Zulus apply an infusion of the root made with human urine, to the ear for earache.

The Sutos use a decoction of the root as a tonic and as ear-drops in earache, and a milk decoction or infusion for chest complaints. In addition they use the plant to fumigate the hut of a person suffering from a cold in the head.

Suto : Mothuntsetso, Tsebapelo, Tsebe-ya-pela— ; *Zulu* : in Dlbe-yempithi—.

GLOSSOCARDIA.

The genus consists of 1 Indo-Malayan species.

Glossocardia Bosvallia DC. (= *G. linearifolia* Cass.) is found in the Upper Gangetic Plains, Central India, Konkan, the Deccan, the South Mahratta Country, North Kanara, and all the plains districts of the Madras Presidency.

The plant is much used in complaints of women.

Bombay : Phatursuwa, Pithapra— ; *Hindi* : Seri— ; *Marathi* : Patharasuva— ; *Naguri* : Pusikata— ; *Poona* : Pittapapada— ; *Sanskrit* ; Pithari— ; *Telugu* : Parapalanamu—.

GLOSSOGYNE.

The genus consists of 5 Indo-Malayan and Chinese species.

Glossogyne pinnatifida DC. occurs in the Punjab Plain, the Upper Gangetic Plain, Kumaon, Chota Nagpur, the South Mahratta Country, Western Bengal, the Northern Circars, and the Deccan of the Madras Presidency.

A preparation from the root is employed by the Santals as an application to snake-bite, and scorpion sting.

Mhaskar and Caius have shown that the root is useless in the antidotal and symptomatic treatments of snake-bite and scorpion-sting.

Gujerati : Pardeshibhangrŏ— ; *Santali* : Barangom bir barangom—.

GNAPHALIUM.

The genus includes 260 cosmopolitan species.

The following species are used medicinally in Europe—*G. luteo-album* Linn., *G. norvegicum* Gunner, *G. supinum* Linn., *G. sylvaticum* Linn., *G. uliginosum* Linn.— ; in China—*G. luteo-album* Linn.— ; in North America—*G. decurrens* Ives, *G. obtusifolium* Linn., *G. ramosissimum* Nutt., *G. uliginosum* Linn.— ; in South Africa—*G. luteo-album* Linn., *G. undulatum* Linn.

Gnaphalium luteo-album Linn. is found throughout India. It occurs in most of the hot and warm temperate countries.

The leaves are used in the Punjab as an astringent and vulnerary.

The Sutos burn the plant in the sickroom to drive away sickness.

Afrikaans: Roerkruid—; *Arabic*: Ra'ra', Sabun'afrit—; *Burma*: Byaingchepiu—; *Egypt*: Luban, Ra'ra', Sabun'afrit—; *Hova*: Ahitrakohovavy, Tranomandrita—; *Igorrote*: Onanat—; *La Reunion*: Immortelle marronne—; *Punjab*: Balraksha—; *South Africa*: Cudweed—; *Suto*: Manku, Musuwane—.

GRANGEA.

The genus consists of 2 palaeotropical species.

Grangea maderaspatana Poir. is a common weed, growing flat on the ground, found throughout India, Baluchistan and Ceylon. It is distributed over tropical and subtropical Asia and Africa.

The herb is a Yunani drug.

The leaves are regarded as a valuable stomachic and to possess deobstruent and antispasmodic properties, and are prescribed in infusion and electuary in cases of obstructed menses and hysteria. They are also sometimes used in preparing antiseptic and anodyne fomentations.

The juice of the leaves is employed as an instillation for earache.

In Indo-China the leaves are considered as an excellent stomachic; they are also used as an antiseptic in fomentation. A decoction of the roasted leaves is given in cough and is used as an emmenagogue.

In Madagascar the leaves are used as a stomachic and antispasmodic.

In Brazil the plant is a popular substitute for chamomile.

Arabic: Afsantin, Khatareka—; *Bengal*: Namuti—; *Betsileo*: Angea—; *Brazil*: Marcella—; *Canarese*: Dovana—; *Gujerati*: Jhinkimundi, Nahanigorakhamundi—; *Hindi*: Mukhatari, Mustaru—: *Hova*: Motomaso, Voamontomosa—; *Indo-China*: Cai dong, Cuc rai, La chan vit—; *Loanda*: Macella—; *Malayalam*: Nelampala—; *Marathi*: Mashipatri—; *Persian*: Baranjasifkowhi, Murava—; *Santali*: Bhediachim—; *Sinhalese*: Velkolondu—; *Sudan*: Phunat—; *Tamil*: Mashipatri—; *Telugu*: Save—; *Urdu*: Afsantin—.

GUIZOTIA.

The genus consists of 8 African species.

Guizotia abyssinica Cass. is a native of tropical Africa, cultivated in various parts of India.

The oil from the seeds is employed as a substitute for ghee and sesamum oil.

Chemical data are available.

Bengal: Gunja, Ramtil, Sirguja—; *Bombay*: Kerani, Ramatila—; *Canarese*: Huchchellu, Ramtil—; *English*: Niger Oil Plant, Niger Seed Plant—; *Gujerati*: Kalatel—; *Hasada*: Jhatinggi—; *Hindi*: Kalatil, Ramtila, Surguja—; *Kolami*: Kallatil, Sarguja, Til—; *Marathi*: Kalitil—; *Naguri*: Maga, Magha, Surgunja—; *Portuguese*: Verbesina da India—; *Santali*: Surguja—; *Telugu*: Valesulu, Vulisi—.

GYNURA.

The genus includes 29 species, inhabiting the warm regions of Asia, Africa, and Australia.

G. auriculata Cass. and *G. pinnatifida* DC. are used medicinally in China; *G. cernua* Benth. in Madagascar; *G. amplexicaulis* Oliv. and Hiern, *G. cernua* Benth. *G. crepidioides* Benth., *G. sarmentosa* DC. in tropical West Africa.

Gynura Pseudo-China DC. is found in South India and Ceylon, in the Sikkim Himalaya at 2,000-4,000 ft, in Pegu and Martaban, extending to Java and Indo-China.

The plant is held in great repute in Indo-China as an emollient and resolvent; it is used whole as a poultice in erysipelas and for tumours on the breasts.

The powdered root, mixed with tea, is given as a drink to parturient women and also to regulate the menstrual flow.

The juice of the leaves is used as a gargle for inflammation of the throat.

Indo-China: Bau dat dai, Tam that gia—; *Mauritius*: Jacobée, Muel schévy, Shoudy mourdi—.

HELIANTHUS.

The genus includes 60 American species. *H. angustifolius* Linn., *H. annuus* Linn., *H. petiolaris* Nutt., and *H. tuberosus* Linn. are used medicinally in North America.

Helianthus annuus Linn., a native of America, is cultivated in India and in many other tropical and subtropical countries.

The growing plant is said to be a cure for malaria, and is used in malarial fever by the inhabitants of the Caucasus. The leaves are spread upon a bed covered with a cloth, moistened with warm milk, and then the patient is wrapped up in it. Perspiration is produced, and this process is repeated every day until the fever has ceased.

The boiled flower heads were used by American Indians for pulmonary affections.

A tincture of the flowers and leaves has been recommended in combination with balsamics in the treatment of bronchiectasis.

The seeds have diuretic and expectorant properties, and have been employed with success in the treatment of bronchial, laryngeal, and pulmonary affections, coughs and colds. If browned in the oven and then made into an infusion they are admirable for the relief of whooping cough.

In China the seeds are administered in dysentery.

A tincture prepared from the seed with rectified spirit of wine is useful for intermittent fevers and ague, instead of quinine. It has been employed thus in Turkey and Persia, where quinine and arsenic have failed, being free from the inconveniences which often arise from giving large quantities of the other drugs.

The oil from the seeds is officinal in Russia; its properties are the same as those of the seeds.

Arabic: Arzivana—; *Bengal*: Bhramoka, Shuriamukti, Suriamuki—; *Bombay*: Surajmaki, Suryakanta—; *Catalan*: Girasol, Mirasol—; *Chinese*: Toung K'oui *Tzeu*—; *Deccan*: Suriyakajhar—; *Dutch*: Zonnebolem—; *Egypt*: Habb-eshshems—; *English*: Lady Eleven o'Clock, Marigold of Peru, Sunflower—; *French*: Anthilion, Couronne de soleil, Girasol, Grand soleil, Grand soleil des jardins, Hélianthe, Soleil cultivé, Soleil rigide, Tournesol—; *German*: Sonnenblume—; *Greek*: Hilios, Hiliotropion—; *Gujerati*: Surajamukhi—; *Hindi*: Hurhuja, Surajmukhi—; *Iraq*: 'Abad-ash-shams, 'Ain-ash-shams, Shams-wa-gamar, Ward-ash-shams—; *Italian*: Clytia, Girasole, Harpalio—; *Konkani*: Jirasol, Suriakamal—; *Kurdish*: Gulah barruzhah—; *Marathi*: Brahmoka, Surajmaka, Suryaphula—; *Pacific Coast*: Comb-flower, Common Sunflower, Garden Sunflower, Sunflower—; *Persian*: Aftabi, Guleaftabeparasta, Guliaftab—; *Portuguese*: Girasol, Heliotropio—; *Punjab*: Surajmukhi—; *Roumanian*: Floarea soarelui, Ruja soarelui—; *Russian*: Padsolnechnik—; *Sanskrit*: Adityabhakta, Suryamukhi, Suryavarta, Suvarchala—; *Spanish*: Girasol, Mirasol—; *Telugu*: Adityabhaktichettu, Poddatringuddachettu, Poddutiruguduchettu—; *Turkish*: Qunah bagan—; *Urdu*: Surajamakkhi—.

HIERACIUM.

The genus includes about 400 species, mostly natives of Europe, but extending all over the Mediterranean region, Northern Asia, Japan, North America, the region of the Andes, and South Africa.

H. amplexicaule Linn., *H. murorum* Linn., *H. pilosella* Linn., *H. virosum* Pall. are used medicinally in Europe.

Hieracium virosum Pall. is found in Kashmir at a height of between 7,000 and 8,000 ft. It occurs in Northern Asia from Dahuria westwards to Europe.

The plant is considered aperient and vulnerary in Spain. It is said to be poisonous.

HYPOCHOERIS.

The genus includes about 45 species, natives of Europe, Northern Asia, the Mediterranean region, and South America. Two of them are widely diffused through cultivation.

Hypochoeris glabra Linn., a native of Europe, is found in the Nilghiris at an altitude of 7,000-8,000 ft.

The root is credited with diuretic, tonic, and slightly aperient properties.

The powdered leaves are a good astringent in haemorrhage. The green herb is vulnerary.

INULA.

The genus includes about 100 species, natives of the Old World.

The following species are used medicinally in Europe—*I. Conyza* DC., *I. crithmoides* Linn., *I. germanica* Linn., *I. graveolens* Desf., *I. Helenium* Linn., *I. viscosa* Ait.—; in China and Indo-China—*I. britannica* Linn.—; in Malaya—*I. japonica* Thunb.—; in North America—*I. Helenium* Linn.—.

The root of *I. Helenium* is officinal in Holland and Portugal.

A. Shrubby. Heads solitary ... ... 1. *I. grantioides.*
B. Herbs. Heads turbinate, terminating numerous slender branches .... 2. *I. graveolens.*
C. Tall, stout herbs. Heads large, solitary or racemose
  1. Heads racemed, $1\frac{1}{2}$-2 in. diameter ... ... 3. *I. racemosa.*
  2. Head solitary, 3-4 in. broad ... ... 4. *I. Royleana.*

1. **Inula grantioides** Boiss. is found in Cutch, Sind, Baluchistan, and Waziristan. It occurs also in South-eastern Arabia.

In Las Bela it is given steeped in water to patients suffering from asthma.

Baluchi: Kolmir, Kulmir, Pir—; *Brahui*: Kolbur, Kulmir—; *Las Bela*: Kolmur, Naro—.

2. **Inula graveolens** Desf. is found in North-Western India, extending westwards to Spain.

In the Punjab the plant is recommended as a diuretic, useful in calculous diseases.

At Basrah the plant is used as a specific for eye-diseases.

Basrah: Shuwasar—; *Cape Peninsula*: Khaki Bush, Khaki Weed—; *Malta*: Fleabane, Fulichi, Zghazigha—.

3. **Inula racemosa** Hook. fil. is found in the temperate and alpine Western Himalaya, ascending from 5,000 ft. to 14,000 ft.

The root and the seeds are used by Yunani practitioners.

The plant is commonly used as an expectorant, and as a resolvent in indurations.

In Kashmir the root is mixed with that of *Saussurea Lappa* as an adulterant.

Arabic: Rasan, Zanjabileshami—; *Kashmir*: Poshkar—; *Persian*: Gharsa, Pilgush, Rasan, Zanjabilishami—; *Urdu*: Rasan—.

4. **Inula Royleana** DC. is found in the temperate Western Himalaya between 7,000 and 11,000 ft.

The plant is considered poisonous.

In Kashmir the root is mixed with that of *Saussurea Lappa* as an adulterant.

Kashmir: Zahelniilkohee—.

JURINEA.

The genus includes 50 species, occurring in the Mediterranean region, Europe, and Asia.

Jurinea macrocephala Benth. is found in the Western Himalaya, from Kashmir to Kumaon at 11,000-14,000 ft.

The bruised root is applied to eruptions, and a decoction is given in colic. It is also considered cordial and administered in puerperal fever.

Kashmir: Dhup—; *Punjab*: Dhup, Dhupa, Gugal, Zhangar—.

LACTUCA.

The genus includes 100 species, inhabiting the Northern Hemisphere, chiefly the northern temperate regions of the Old World.

All lettuces possess a milky juice that flows freely from any wound. When dry, the juice hardens, turns brown, and is known as 'lactucarium'. It is a calmant, often used as a substitute for opium. It is officinal in Holland, Hungary, Portugal, and Spain.

The following species are used medicinally in Europe—*L. sagittata* Waldst. and Kit., *L. Scariola* Linn., *L. virosa* Linn.—; in China—*L. Scariola* Linn., *L. Thunbergii* Max.—; in Indo-China—*L. Fischeriana* DC., *L. indica* Linn.—; in North America—*L. canadensis* Linn.—; in Guiana—*L. quercina* Linn.—; in West Africa—*L. capensis* Thunb., *L. taraxacifolia* Schum. and Thonn.—.

A.	Leaves runcinate, pinnatifid	2. *L. runcinata.*
B.	Nearly entire (rarely sinuate-pinnatifid) smaller leaves ...	1. *L. remotiflora.*
C.	Leaves suberect, sessile, runcinate-pinnatifid, spinulose-toothed; midrib prickly beneath	3. *L. Scariola.*

1. **Lactuca remotiflora** DC. is found in the Deccan, Banda, and Sind, extending to Arabia.

The whole plant is used as a remedy for chronic obstructions of the liver and bowels, and as a diuretic in calculous affections.

Goa: Taraxaco—; *Gujerati*: Pathardi—; *Marathi*: Undirachakan, Undirakani—.

2. **Lactuca runcinata** DC. spreads over the Punjab, the Upper Gangetic Plain, Sind, the Deccan, and most of the plains districts of the Madras Presidency.

The plant is diuretic, tonic and slightly aperient.

Goa: Taraxaco—; *Marathi*: Undirachakan—; *Pab*: Shamur—.

3. **Lactuca Scariola** Linn. occurs in Western Tibet at 9,000-12,000 ft., in the Western Himalaya from Murree to Kunawar at 6,000-11,000 ft. It extends to Siberia and westwards to the Atlantic.

The plant occupies an important place in the materia medica of the Yunanists.

The fresh plant is a mild sedative, anodyne, purgative, diuretic, diaphoretic, and antispasmodic. It has been found useful in the treatment of the coughs in phthisis, bronchitis, asthma, and pertussis.

A decoction of the seeds is commonly used as a demulcent. Boiled, and made into a confection, the seeds are given in cases of bronchitis, especially chronic ones.

Water distilled from lettuce is used in France as a mild sedative in doses of 2 to 4 oz., and the fresh leaves boiled in water are sometimes used as a cataplasm. Lettuce poultice is applied to burnings and scaldings, and to painful and irritable ulcers.

Arabic: Khas—; *Bengal*: Kahu, Salad—; *Catalan*: Ansiam llarch—; *Chinese*: Pai Chu, Wo Chu—; *Danish*: Laktuk—; *Dutch*: Latuw—; *English*: Garden Lettuce, Lettouce, Lettuce—; *French*: Laitue, Laitue cultivée, Laitue des jardins—; *German*: Gartenlattich, Gartensalat, Lattich, Salat, Sommerendivie—; *Greek*: Thridax—; *Hindi*: Kahu, Khas, Salad—; *Hungarian*: Kerti salata—; *Italian*: Guado, Lactuga, Lattuga—; *Languedoc*: Lacholebri, Lachougo, Lachuga—; *Malta*: Prickly Lettuce, Lettuce, Lattuga, Hass, Hassa salvagga—; *Pacific Coast*: Compass-plant, Horse Thistle, Prickly Lettuce, Wild Lettuce—; *Persian*: Kahu—; *Polish*: Loczyga, Loezya—; *Portuguese*: Alface brava, Alface menor, Leituga—; *Punjab*: Kahu—; *Roumanian*: Laptuc—; *Russian*: Laktuk—; *Sind*: Kahu—; *Sinhalese*: Salada—; *Spanish*: Lechuga, Lechuga larga, Lechuga romana—; *Swedish*: Laktuk—; *Tamil*: Salattu—; *Telugu*: Kavu—; *Urdu*: Kahu—; *Uruguay*: Lechuga silvestre—.

Laggera.

The genus consists of 10 species, tropical African and Indian.

Laggera alata Schultz-Bip. occurs in the tropical Himalaya between 1,000 and 5,000 ft. from Simla eastwards to Sikkim, and southwards in hilly districts ascending to 6,000 ft. in the Nilghiris and to 7,000 ft. in Ceylon. It is distributed over Java, the Philippine Islands, China, and tropical Africa.

The herb is used in Madagascar as a disinfectant.

Hova : Ahitandriana— ; *Menabe* : Argodro—.

Lamprachaenium.

L. monocephalum Benth., the only species known, occurs at Mahableshwar, the Konkan, the South Mahratta Country, and Mysore.

The plant smells of chamomille, and is used as an aromatic bitter. The Ayurvedists recommend it for leucoderma and other skin diseases.

Bombay : Brahmadandi— ; *Sanskrit* : Ajadandi, Brahmadandi—.

Launaea.

The genus consists of 30 tropical and subtropical species.

A. Achenes winged ... ... 3. *L. glomerata.*
B. Achenes not winged
  I. Heads terminal on the paniculately branched flowering stems
    1. Radical leaves sinuate lobed or pinnatifid ... 1. *L. aspleniifolia.*
    2. Radical leaves rosulate, runcinate-pinnatifid ... 2. *L. chondrilloides.*
  II. Heads more or less racemose on the flowering stem or its branches ... ... 4. *L. nudicaulis.*
  III. Heads solitary or fascicled at the nodes of the flagelliform rooting flowering stems ... 5. *L. pinnatifida.*

1. **Launaea aspleniifolia** Hook. fil. is found throughout the plains of India, from the Punjab and the Upper Ganges to Bengal and Assam, the Sunderbunds, the Circars, Burma, Tenasserim, and the Andamans.

The root of this plant in combination with other drugs is used as a lactagogue by the Santals.

Bengal : Tikchana— ; *Santali* : Birmalla—.

2. **Launaea chondrilloides** Hook. fil. is found in the Punjab, at Multan and in the low hills at Rawalpindi, in Sind, Baluchistan, Afghanistan, Persia, Arabia, and Egypt.

The plant is credited with the properties of a lactagogue.

Baluchi : Halaku, Mahari—.

3. **Launaea glomerata** Hook. fil. occurs in the Punjab, Baluchistan, Sind, Cutch, Kathiawar, and Mount Abu. It extends to Persia, Arabia, Egypt, and Algeria,

In Baluchistan the decoction, mixed with some wheat meal, is made into a poultice and applied to sore eyes.

Arabic: Halawat-el-ghazlan, Hufeifah, Huwwa, Huwwat-el-kilab—; *Baluchistan*: Aghut, Machi halako, Reki halaku—; *Egypt*: Abad, Helawan, Hudan, Huveywa, Huwry, Huwweyt-el-kilab, Shegeret-el-libbeyne—; *Quetta*: Alko—.

4. **Launaea nudicaulis** Hook. fil. is found more or less throughout the plains of India, from Bengal and Bihar to the Punjab, ascending the Western Himalaya to 8,000 ft. in Kumaon. It is distributed over the Deccan, Sind, and Baluchistan, extending westwards to Afghanistan and the Atlantic.

In Las Bela the leaves are applied to the head of children suffering from fever.

Arabic: Hindibe, Hua—; *Baluchi*: Halaku, Kahoshonk, Khargoshkah, Machi malaku, Mahari halaku, Reki halaku—; *Brahui*: Halaco, Marubahi—; *Kharan*: Maharialoko—; *Las Bela*: Bhattri—; *Ormara*: Shatrag—; *Pab*: Kharsagut—; *Punjab*: Batthal, Dudhlak, Spudukei, Tarizha—; *Rajputana*: Akria, Ban gobi, Jangli gobi—.

5. **Launaea pinnatifida** Cass. is found along the sandy coasts of India, from Bengal to Ceylon, Penang, Madras, and Malabar. It extends to the East African Coast, Egypt, and Mauritius.

In Bombay the plant is used as a lactagogue; in Goa it is given as a tonic, diuretic, and mild aperient.

The juice is applied in rheumatic affections, and used as a soporific for children.

Bombay: Pathri—; *Cutch*: Gewar—; *Goa*: Almirao—; *Gujerati*: Bhonpatri—; *Hindi*: Bankau—; *Indo-China*: Pissenlit maritime—; *Marathi*: Bhonpatri, Pathradi, Paththa—; *Porebunder*: Kormani—; *Sind*: Bankahu—.

MATRICARIA.

The genus includes about 50 species, mostly natives of Europe and the Mediterranean region as far as India, and of South Africa. *M. Chamomilla* Linn. and *M. suaveolens* Pursh. are used medicinally in Europe; *M. glabrata* DC., *M. globifera* Fenzl., *M. multiflora* Fenzl., *M. nigellaefolia* DC. in South Africa; *M. Chamomilla* Linn. and *M. discoidea* DC. in North America.

Leaves bipinnatifid ... ...1. *M. Chamomilla.*
Leaves small in outline, narrowly oblong, cuneate, pinnatipartite ... ... 2. *M. lasiocarpa.*

1. **Matricaria Chamomilla** Linn. occurs in the Punjab and the Upper Gangetic Plain. It extends to Japan and Northern Asia, and westwards to the Atlantic.

The plant is a well known Yunani drug.

The flowers are considered stimulant, attenuant, and discutient. They are used in constitutional debility, hysteria, dyspepsia and intermittent fevers. The warm and strong infusion of the flowers is emetic, while a weak infusion acts as a tonic and febrifuge. In flatulence and colic, Chamomile oil is the most effectual of all remedies; in Gujerat it is used externally for rheumatism, The flowers are considered an excellent remedy in children's ailments in many parts of Europe. They act as a nerve sedative and also as a tonic upon the gastro-intestinal canal. It is a useful remedy during dentition, in cases of earache, neuralgic pains, stomach disorders, and infantile convulsions.

The flowers are officinal in Austria, Denmark, Germany, Holland, Hungary, Italy, Japan, Norway, Portugal, Russia, Spain, Sweden, Switzerland, and Turkey.

In China the leaves are used as a depurant.

Arabic: Babunah, Shajrab-el-kaffoor, Tuffah-el-ard—; *Catalan*: Camamilla, Camamilla comú, Camamilla de Urgel—; *Chinese*: Houng Kiou—; *Danish*: Kamille—; *Egypt*: 'Ain-el-qutt, Babunngi, Babunnguy—; *English*: Bitter Chamomile, German Chamomile, Persian Chamomile—; *French*: Amarou, Astartife, Camomèle, Camomille d'Allemagne, Camomille commune, Camomille du Nord, Chamille, Malherbe, Mandiane—; *German*: Feldkamille, Gelbermaiblume, Haermelchen, Halmerl, Hameln, Harmel, Haugenblume, Helmerchen, Hermaennle, Hermchen, Hermeln, Herminchen, Hermligen, Hermuentzel, Hermunel, Kamilechte, Kamille, Karnille, Kummerblume, Laugenblume, Magdblume, Maidblume, Matronenkraut, Mutterkamille, Mutterkraut, Raimain, Ramerian, Romeien, Romer, Romerai, Romey, Saekfit, Stomeienblume, Thamillen, Zaeuwih—; *Greek*: Armen—; *Gujerati*: Babuna—; *Italian*: Camomilla comune, Capomilla—; *Malta*: Chamomille, Gowan, Camomilla, Camumilla—; *Naples*: Cambomilla—; *Norway*: Kamille—; *Parma*: Margariteine de pra—; *Pavia*: Crespola—; *Persian*: Babunah—; *Piedmont*: Amoreggiola, Camamia—; *Portuguese*: Camomilla dos Allemaes—; *Potenza*: Cambomilla—; *Punjab*: Babuna, Suteigul—; *Reggio*: Camamella—; *Romagna*: Camomella, Matricaria, Matricheria—; *Roumanian*: Musatel, Romanita—; *Russian*: Romashka aptetchnaya—; *Sardinia*: Carbomiglia, Capomilla, Crabumiglia—; *Sicily*: Calumidda—; *Spanish*: Manzanilla comun, Manzanilla de Urgel—; *Swedish*: Kamomill—; *Tuscany*: Camomila, Camumilla, Capomilla, Caprimilla, Capumilla—; *Urdu*: Babunah—; *Verona*: Erba Maria, Margarite, Samariza—.

2. **Matricaria lasiocarpa** Boiss. occurs in Baluchistan.

At Nushki a decoction of the flowers is used to cure fever.

Dak: Piunpulli—; *Nushki*: Painphuli—.

MICROGLOSSA.

The genus consists of 6 species, Asiatic and African.

M. Afzelii O. Hoffm. and *M. volubilis* DC. are used medicinally in tropical West Africa.

Microglossa volubilis DC. occurs in the Khasia Hills, Assam, the Naga Hills, Cachar, Burma from Pegu to Penang, the hill forests of Malaya and China. It is also found in some parts of tropical West Africa.

In Gold Coast the plant is given as an enema to cure fever in babies. In Liberia it is used as a vermifuge. In Cameroons Mountain area it is a remedy for severe cough.

A decoction of the root is used for colic in Malaya. The powdered root is used as a snuff to relieve colds in West Africa. The juice of the root is the part used as an eye medicine in West Tropical Africa, it is dropped through fine linen in the eye. The refuse from the crushed roots is mixed with shea butter, melted and smeared over the eyelids to reduce the slight swelling of the lids. This is applied at bedtime and is repeated weekly.

The juice of the warmed leaves is put in sore eyes, and applied also as a remedy for ringworm of the scalp. A tea-like infusion is taken for fever with headache, and also as a lotion or fumigation to cause perspiration, or by inhalation. A decoction is taken by women in labour. It is said to be a specific for yellow fever and for dropsy, and a reliable remedy in blackwater fever.

Bakwiri: Bendem-bende—; *Basa*: Gban-gbah—; *Fanti*: Esono-mbabae—; *Ibo*: Okbak kwu—; *Kibbi*: Asomerewa—; *Malay*: Poko ragin—; *Mende*: Gimbo yufi, Gimbui, Gimbu lufi, Kimbo yufi—; *Twi*: Asomerewa, Esono-mbabae—; *Ubuluku*: Okbak kwu—.

MIKANIA.

The genus includes about 60 species, all American, one cosmopolitan.

M. cordifolia Willd. and *M. officinalis* Mart. are used medicinally in Brazil.

Mikania scandens Willd. is found in Eastern Assam, in the Duphla Hills, Burma, and the Malay Peninsula from Tenasserim to Singapore. It is distributed over Siam, the Malay and the Philippine Islands.

The Thongas use the plant as a remedy for snake bite and scorpion sting.

Fiji: Wa batako—; *French Guinea*: Nore—; *Mexico*: Guaco—; *Thonga*: Kamele—; *Yoruba*: Iyawa—; *Zambesi*: Wedwedwi—.

NOTONIA.

The genus consists of 12 palaeotropical species.

Notonia grandiflora DC. occurs in the hilly districts of the Western Peninsula from the Konkan southwards: Konkan, Deccan and Western Ghats of the Bombay Presidency, South Deccan and Carnatic of the Madras Presidency. Also in the Batticaloa district of Ceylon.

The plant was brought forward in 1860, by Dr. A. Gibson, as a preventive of hydrophobia. The mode of administration is as follows:—About 4 ounces of the freshly-gathered stems, infused in a pint of cold water for a night, yield in the morning, when subjected to pressure, a quantity of viscid greenish juice, which, being mixed with water, is taken at a draught. In the evenings, a further quantity of the juice, made up into boluses with flour, is taken. These medicines are directed to be repeated for three successive days.

Dr. Waring says that from official documents placed at his disposal, it appears that the remedy has been tried in numerous cases; but as at the time of the infliction of the wound, caustic was applied locally in the majority of cases, it is difficult to determine how far the Notonia operated, if at all, as a prophylactic.

An extract of the herb was tried by the late Dr. Haines and myself on dogs, and afterwards at the European Hospital in Bombay (1864). In one drachm doses it had a feebly aperient action; no other effect was observed (Dymock).

Bombay: Gaidar—; *Marathi*: Wanderroti—; *Telugu*: Kundelucheviyaku—.

OTHONNOPSIS.

The genus consists of 8 species, inhabiting Africa and Western Asia.

Othonnopsis intermedia Boiss. is found in Waziristan at 6,000-7,000 ft. and in Baluchistan whence it spreads westwards to Persia.

In Baluchistan the plant is used as a poultice for the chest. The leaves are made into a paste with oil; they are then spread on a large chapati and laid on the head of a patient suffering from cold or fever.

In the Bolan Pass the plant is used as a cure for head aches; in Loralai for boils and pimples.

Baluchi: Manguli—; *Bolan Pass*: Mungli, Munglian—; *Brahui*: Manguli—; *Loralai*: Gango—; *Quetta*: Gangu, Manguli—; *Shahrig*: Gangu—; *Zhob*: Gangu—.

PEGOLETTIA.

The genus consists of 5 species, one in Java, the others in Africa.

Pegolettia senegalensis Cass., a native of tropical Africa, occurs in Baluchistan.

At Kharan, in Quetta, it is given with ghi to children to make them strong. It is boiled and the juice is applied to wounds of camels as a cure.

Kharan: Kuchitho—; *Kohlu*: Shin Bunt—.

PICRIS.

The genus includes about 45 species, found in Europe, North Africa and Asia, one cosmopolitan.

Picris hieracioides Linn. occurs in the Temperate Himalaya from Murree to Bhutan at 6,000-8,000 ft., ascending to 10,000 ft. in Sikkim. It is also found in the Khasia Hills at 4,000-6,000 ft., and in the Nilghiris at 5,000-8,000 ft. It extends to North Asia and Japan, and to West Asia, Europe, and North Africa.

In Indo-China the bitter leaves are used by the Muong as a febrifuge.

Indo-China: Mao lien thai, Mat dat—.

PLUCHEA.

The genus includes 30 tropical and subtropical species.

The following species are used medicinally in Indo-China—*P. eupatorioides* Kurz., *P. indica* Less., *P. polygonata* Gagnep., *P. pteropoda* Hemsley—; in Brazil—*P. Quitoc* DC.—; in Somaliland—*P. ovalis* (Pers.) DC.—.

I. Leaves obovate or oblanceolate, subserrate, glabrous ... 1. *P. indica.*
II. Leaves sessile, very coriaceous, oblong or oblanceolate, hoary-pubescent ... ... 2. *P. lanceolata.*
III. Leaves pinnatifid ... ... 3. *P. pinnatifida.*

1. **Pluchea indica** Less. is found in salt marshes from the Sunderbuns to Malacca and Penang, the Malay Archipelago, and China.

The root and leaves are used in Patna as astringents and antipyretics.

In Indo-China the roots in decoction are prescribed in fevers as a diaphoretic, and an infusion of the leaves is given internally in lumbago.

Bengal: Kukronda, Munjurukha—; *Burma*: Kayu—; *Cambodia*: Pras anlok—; *Iloilo*: Tulolalaqui—; *Indo-China*: Cuc tan, Cuc tan o, La luc, Pros anloc, Tu bi—; *Malay*: Poko beluntas—; *Tagalog*: Lagundilati—.

2. **Pluchea lanceolata** C. B. Clarke is found in the Punjab and the Gangetic Plain as far as Cawnpore, in Sind, Afghanistan, westwards to North Africa.

The leaves are aperient.

Agra: Chotikalia—; *Aligarh*: Banserai—; *Cawnpore*: Sorahi—; *Gujerati*: Rasana, Rashana—; *Hindi*: Rasana, Rashana—; *Marathi*: Rashna, Rasna—; *Punjab*: Marinandai, Rasana, Reshae, Reshambuti, Reshami, Sarmei—; *Pushtu*: Marwande—; *Rajputana*: Chotakalia—; *Sanskrit*: Rasna—; *Sind*: Kurasanna—.

3. **Pluchea pinnatifida** Hook. fil. occurs in Baluchistan and Somaliland.

In Ormara the plant is rubbed on inflamed or wounded places.

The stems are employed by the Somalis for the cure of almost all diseases; but especially for pain in the bowels, lack or loss of the appetite for food, and debility after fevers.

Ormara: Majassar, Zika—.

PULICARIA.

The genus includes 30 species, European, Asiatic, and African. *P. dysenterica* Gaertn. is used medicinally in Europe; *P. capensis* DC. and *P. scabra* Drme in South Africa; *P. crispa* Schultz-Bip. in West Tropical Africa.

I.	Involucral bracts slender. Pappus double, outer of a crown of short scales, inner of slender hairs ...	2. *P. dysenterica*.
II.	Involucral bracts very slender. Pappus-hairs bearded, thickened at the tips; outer scales connate with the hairs and deciduous with them	1. *P. crispa*.
III.	Involucral bracts elliptic-lanceolate, acute. Pappus double; outer a short jagged crown, inner of flattened shining rigid scabrid hairs	3. *P. glaucescens*

1. **Pulicaria crispa** Schultz-Bip. occurs in the Punjab, the Upper Gangetic Plain, Behar, Bengal, Sind and Baluchistan; whence it spreads to Afghanistan, Persia, North and West Africa.

In the Salt Range the dried plant is applied as a vulnerary to bruises and sores of bullocks.

In Jaisalmer and Jodhpur the bruised leaves are applied to the head to relieve headache.

In Baluchistan the plant is boiled and the liquid given to children in whose stomach milk turns sour.

In Northern Nigeria it is applied locally for swellings and bruises, and rubbed on the temples for headache; a decoction is also taken for febrile conditions.

Arabic: Afrakh, Dehded, Desdas, Dithdath, Kanuf, Karwan, Qutqat, Ra'ra', Sabut, Tajar—; *Baluchi*: Bo-i-madaran, Boraku—; *Brahui*: Bo-i-madaran, Pihupulli, Rambo—; *Egypt*: Afrash, Dithdath, Gidiai, Khauf, Kutkat, Ra'ra', Sabat, Tagar—; *Fulani*: K'urar shanu—; *Hausa*: Bafuri, Balbela, Farar saura—; *Hindi*: Buhrna—; *Iraq*: Jifjaf, Juwaifah—; *Kano*: K'urar shanu—; *Katagum*: Bilbila—; *Pila-pila*: Paria zoupen—; *Punjab*: Bui, Gidi, Phatmer, Sutei—; *Rajputana*: Dhola lizru—; *Songhai*: Tarkunde dierfendu—.

2. **Pulicaria dysenterica** Gaertn. is found in Kashmir at 5,000-6,000 ft., extending westwards to Algeria and Britain.

The root is still a popular remedy for dysentery in many countries of Europe.

Arabic: Rara ejub, Rara jeub—; *English*: Cammock, Common Fleabane, Fleabane, Fleabane Millet, Herb Christopher, Middle Fleabane—; *French*: Aunée des prés, Aunée dysentérique, Conyse, Conyse des prés, Enule tonique, Herbe saint Roch, Inule conysière, Inule dysentérique, Pulicaise dysentérique—; *German*: Dumrians—; *Iraq*: Jifjaf, Juwaifah—; *Malta*: Common Fleabane, Menta selvatica, Mentastro—.

3. **Pulicaria glaucescens** Jaub. and Spach. is found in the Punjab, the Salt Range and Murree, Waziristan, Baluchistan, and Persia.

The plant is ravenously eaten by camels and is reputed to be strengthening to them; but it acts as a strong purgative.

Baluchi: Kolbur, Kunchid, Kunchito—; *Brahui*: Kolbur, Ler Mazonk—; *Makrani*: Kunchid—.

SAUSSUREA.

The genus includes 125 species, occurring in the northern temperate regions.

A. Heads sessile or shortly peduncled
  I. Pappus double, hairs all feathery. Stem 4-10 ft. ... 4. *S. Lappa.*
  II. Pappus brown, outer bristles scabrid or absent. Stem 1-18 in. ... ... 5. *S. obvallata.*
B. Heads long-peduncled
  I. Heads inclined, nodding ... ... 3. *S. hypoleuca.*
  II. Heads erect
    1. Inflorescence glabrous. Achenes smooth 10-ribbed. 1. *S. affinis.*
    2. Inflorescence cottony. Achenes 5-angled muricate. 2. *S. candicans.*

1. **Saussurea affinis** Spreng. is found in Bengal from Sylhet to the foot of the Nepal Hills. It also occurs in Burma, and it extends to China, Japan, and Eastern Australia.

In Assam the juice of the root is given with other medicines for diseases of women.

Assam: Gangamula—.

2. **Saussurea candicans** Clarke occurs from the Salt Range, Hazara and Kashmir to Bhutan at 2,000-7,000 ft. It is found in Baluchistan and Afghanistan.

The seeds are carminative. They are used for horses in the Punjab.

In the Pab Hills in Jhalawan the seeds are considered as a cure for horse bite.

Pab Hills: Kareji—; *Punjab*: Batula, Kaliziri—.

3. **Saussurea ypoleuca** Spreng. occurs in the Temperate Himalaya from Kashmir to Sikkim at 7,000-13,000 ft. It extends to Indo-China.

The leaves are considered purgative and antisyphilitic in Indo-China.

Annam: Moc huong—; *Indo-China*: Mu hsiang—.

4. **Saussurea Lappa** Clarke is found in Kashmir between 8,000 and 12,000 ft.

The root is equally popular with Ayurveda and Yunani practitioners.

The root is prescribed as a stomachic and tonic, and in the advanced stage of typhous fever. In the Punjab, it is applied in powder to ulcers, for worms in wounds, and also in rheumatism; it is also considered depurative and aphrodisiac.

In Persia Costus root is prescribed externally and internally for various complaints, and is applied locally to ward off the effects of snake and animal bites.

For snake bite the root is given in Ceylon internally in powder form or in the form of a decoction.

Sanskrit writers on Materia Medica have prescribed the root and stem in snake bite and scorpion sting, but Mhaskar and Caius have shown experimentally that neither of these drugs is an antidote to either snake or scorpion venom.

As a medicine the root is considered carminative and stimulant in China, whereto it is exported in enormous quantities.

Chopra and De (*Ind. Journ. Med. Research*; October, 1929) are responsible for a very valuable investigation into the properties of the root. They thus summarise their work:—

(1) *Saussurea Lappa* or *kut* root grows on the moist slopes of the Northern Himalayas at a height of 8,000 to 13,000 ft. above the sea-level.

(2) The chief active constituents of the root are:—

(i) An essential oil 1.5 per cent, (ii) an alkaloid which has been named *saussurine* 0.05 per cent, (iii) Resin 6.0 per cent. Besides these there occur a fixed oil, traces of a bitter substance, small quantities of tannins, inulin, potassium nitrate, sugars, etc.

The leaves contain no essential oil but 0.025 per cent of the alkaloid *saussurine*.

(3) The essential oil has a strong aromatic, penetrating and fragrant odour. It has antiseptic and disinfectant properties; it relaxes the involuntary muscle tissue; it is a cardiac stimulant, a carminative, an expectorant and a diuretic.

(4) The alkaloid *saussurine* has a depressant action on the vagus centre in the medulla as well as on the involuntary muscle fibres of the bronchioles and gastro-intestinal tract. It produces a

slight but persistent rise of blood-pressure and increases the force of contraction and amplitude of the ventricles.

(5) The drug has a remarkable effect in controlling attacks of bronchial asthma, especially those of the vagotonic type. The paroxysms are cut short by the combined action of the essential oil and the alkaloid present in the root. The essential oil during its excretion in the lungs not only relaxes the bronchial muscle but has a marked expectorant action which relieves turgescence of the mucosa. It may be pointed out, however, that although the drug relieves asthmatic attacks, it does not produce permanent cure unless the casual factors are investigated and removed.

The drug is also useful in persistent hiccough.

(6) The drug has no anthelmintic action, nor has it any action against malaria, leprosy and rheumatism as has been claimed by writers of the indigenous systems in this country.

Arabic: Kust, Kustabeheri, Kustulhalu—; *Bengal*: Kur, Pachak—; *Bhote*: Rusta—; *Bombay*: Ouplate—; *Canton*: Muk heung—; *English*: Costus—; *Gujerati*: Kut, Upaleta—; *Hindi*: Kot, Kur, Kust, Kut, Pachak—; *Kashmir*: Postkhai—; *Malaya*: Mook heong, Mu hsiang—; *Malayalam*: Sepuddy—; *Persian*: Bughenagh, Khost, Koshnaha, Kust, Kutshirin, Kuttalkh—; *Punjab*: Kot, Kust, Kut, Kuth—; *Sanskrit*: Agada, Amaya, Apya, Bhasura, Dushta, Gada, Gadakhya, Gadavha, Gadavhaya, Haribhadraka, Jarana, Kadakhya, Kakala, Kashmirja, Kaubera, Kinjalka, Kushtha, Kuthika, Kutsita, Niruja, Padmaka, Pakala, Pakalam, Paribhadraka, Paribhavya, Pavana, Rama, Roga, Rogavhaya, Ruja, Ruk, Utpala, Vaniraja, Vyadhi, Vyapya—; *Sinhalese*: Godamahanel—; *Tamil*: Goshtam, Kostum, Putchuk—; *Teheran*: Butenak—; *Telugu*: Changala, Kustam—; *Urdu*: Kut—.

5. **Saussurea obvallata** Wall. is found in the Western Himalaya from Kashmir to Sikkim at 10,000-15,000 ft., spreading to the Altai Mountains.

The root is applied to cuts and bruises.

North-Western Himalaya: Bergandutongur—; *Punjab*: Birmkanwal, Kanwal—.

SENECIO.

The genus includes 1,450 cosmopolitan species, inhabiting chiefly the temperate regions and the mountains of the tropics.

The following species are used medicinally in Europe—*S. Cineraria* DC., *S. Doria* Linn., *S. incanus* Linn., *S. Jacobaea* Linn., *S. viscosus* Linn., *S. vulgaris* Linn.—; in China—*S. campestris* DC. *S. nikoënsis* Miq., *S. palmatus* Pall., *S. scandens* Ham.—; in Indo-China—*S. Kaempferi* DC. *S. palmatus* Pall., *S. scandens* Ham.—; *in North America*—*S. aureus* Linn., *S. Cineraria* DC., *S. vulgaris* Linn.—; in Mexico—*S. cervariaefolius* Sch., *S. Grayanus* Hemsl.—; in Madagascar—*S. Ambavilla* Pers., *S. erechthitoides* Baker, *S. faugasioides* Baker, *S. Hildebrantii* Baker, *S. microdontus* Baker—; in Mauritius and La Reunion—*S. Ambavilla* Pers.—; in South Africa—*S. albanensis* DC. var. *leiophyllus, S. asperulus* DC., *S. brachypodus* DC., *S. bupleuroides* DC., *S. concolor* DC., *S. deltoideus* Less., *S. Dregeanus* DC. var. *discoideus, S. erubescens* Ait., *S. Gerardi* Harv., *S. lasiorhizus* DC., *S. leontodontis* DC., *S. macrocephalus* DC. var. *hirsutissimus, S.*

orbicularis Sond., *S. othonnaeflorus* DC., *S. quinquelobus* DC., *S. rhyncholaenus* DC., *S. Serra* Sond., *S. serratuloides* DC., *S. speciosus* Willd., *S. subcoriaceus* Schltr., *S. tamoides* DC., *S. tanacetoides* Sond., *S. vulgaris* Linn.—; in Nigeria—*S. abyssinicus* Sch.-Bip., *S. baberka* Hutch., *S. Biafrae* Oliv. and Hiern—.

The genus SENECIO is of considerable toxicological importance in South Africa. Various species have from time to time been regarded as causing disease in man and animal.

Two alkaloids, senecifoline and senecifolidine, have been isolated from *S. barbellatus* DC.; one, senecionine, from *S. vulgaris* Linn.

A. Heads turbinate or obconic, all radiate, usually bracteolate. Involucral bracts 1-seriate ... ... 4. *S. tenuifolius.*
B. Perennial herbs with long-petioled, very broad orbicular, reniform or palmate radical leaves and cauline leaves with large sheaths
  Leaves palmately lobed. Heads corymbose 2. *S. Jacquemontianus.*
C. Heads few- or many-flowered. Flowers all pappose. Involucral bracts uniseriate
  1. Herbaceous, glabrous or sparsely pubescent. Leaves petioled, membranous, cordate or subreniform and 3-7-angled or palmately lobed ... ... 3. *S. quinquelobus.*
  2. Shrubby. Heads in axillary and terminal corymbs ... 1. *S. densiflorus.*

1. **Senecio densiflorus** Wall. is found in the Central and Eastern Himalaya from Nepal to Bhutan at 5,000-7,000 ft., in the Khasia Hills at 4,000-6,000 ft., and in Burma.

The leaves are applied to boils as an emollient and maturant.

Punjab: Chitawala—.

2. **Senecio Jacquemontianus** Benth. is apparently endemic in Kashmir between 8,000 and 13,000 ft.

The root is used in Kashmir as a nervine tonic.

Kashmir: Hatermul, Poshkar—.

3. **Senecio quinquelobus** Hook. fil. and Thunb. occurs in the Temperate Himalaya from Garhwal to Bhutan at 10,000-12,000 ft.

In Kanawar the seeds are given for colic.

Punjab: Morta—.

4. **Senecio tenuifolius** Burm. is found on the dry hills of the Western Ghats from the Konkan southwards. It also occurs in Java.

The leaves are used as an emollient and vulnerary.

Punjab: Mentog, Nimbar, Sanggye—.

SIEGESBECKIA.

The genus consists of 4 species, found in tropical and warm temperate regions.

Siegesbeckia orientalis Linn. occurs throughout India and Ceylon, ascending to 5,000 ft. in the Himalaya and other mountains. It is found in most of the tropical and subtropical regions of both hemispheres.

It has a high reputation as a valuable depurative, and also for its healing properties in gangrenous ulcers and sores. It is strongly recommended in diseases of the urethra.

Externally, a mixture of equal parts of the tincture and glycerine has been tried in Europe with good effect in ringworm and similar parasitic eruptions. Antiseptic properties have been ascribed to the fresh plant, applied to unhealthy ulcers.

In Indo-China the whole plant is prescribed as a cardiotonic.

In La Reunion the plant is used as a stimulant, diaphoretic, antiscorbutic, and sialagogue. It is considered anthelmintic in small doses.

In Tahiti the plant enters into the preparation of every cure for wounds, sprains, dislocations, contusions. It is also used to favour menstruation.

China : Hsi Hsien—; *French* : Guérit vite, Herbe de Flacq, Herbe de laque, Herbe divine, Herbe grasse, Herbe guérit vite—; *Garhwal* : Lichkura—; *Gujerati* : Pilibadkadi—; *Indo-China* : Cho de, Hy thiem thao, Kinh gioi dat, Luoi dong, Nu ao ria, Riem—; *La Reunion* : Colle-colle, Guérit-vite, Herbe divine, Herbe grasse, Herbe Saint Paul, Souveraine—; *Mauritius* : Herbe divine, Herbe de Flacq, Herbe grasse, Herbe guérit vite—; *Mundari*, Bindiramkata, Hatubirbiri, Ribribi—; *Sadani* : Latlati—.

SILYBUM.

The genus consists of 2 Mediterranean species.

Silybum Marianum (Linn.) Gaertn. occurs in the Punjab and the North-Western Himalaya at Peshawar and Hazara, and from Kashmir to Jamu at 6,000-8,000 ft. It extends westwards to North Africa and Europe.

The plant probably possesses antiscorbutic and lithotriptic properties. It is in popular use in Germany for curing jaundice and kindred biliary derangements. It also acts as a demulcent in catarrh and pleurisy. The decoction when applied externally is said to have proved beneficial in cases of cancer.

Disarmed of its prickles and boiled, it is worthy of esteem, and thought to be a great breeder of milk and proper diet for women who are nurses. The warm infusion scarcely ever fails to procure a proper supply of milk. It is considered one of the best medicines which can be used for the purpose.

The leaves are sudorific and aperient.

The seeds are pungent, antispasmodic, and demulcent; they have been found of special value in haemorrhages.

California : California Mustard—; *Catalan* : Card gallofer, Card mariá, Cardot, Cart gallofer, Cart de Maria—; *Dutch* : Mariendistel, Melkdistel, Vrouwendistel—; *Egypt* : Lekhlikh, Shok-el-ghazal—; *English* : Holy Thistle, Lady's Thistle, Marian Thistle, Milk Thistle—; *French* : Artichaut sauvage, Carthame maculé, Chardon argenté, Chardon lacté, Chardon Marie, Chardon Notre-Dame, Chardon taché, Epine blanche, Lait de Notre-Dame, Lait de sainte Marie—; *German* : Feedistel, Frauendistel, Froschdistel, Mariendistel, Silberdistel, Wehedistel, Wolldistel—; *Greek* : Silybon—; *Iraq* : Gul aghan—; *Italian* : Cardo del latte, Cardo di Maria, Cardo Mariano—; *Malta* : Blessed-Thistle, Milk Thistle, Cardo mariano, Xeuk baghli—; *Pacific Coast* : St. Mary's Blessed Thistle, St. Mary's Holy Thistle—; *Roumanian* : Armurariu—; *Russian* : Ostropestro—; *Spanish* : Borriquero, Cardo borriquero, Cardo de asno, Cardo de Maria, Cardo lechal, Cardo lechero—; *Swedish* : Sempertin—; *Uruguay* : Cardo asnal, Cardo lechero, Cardo maria, Cardo mariano—.

SOLIDAGO.

The genus includes 90 species, mostly North American, one of them cosmopolitan in the northern temperate regions.

The following are used medicinally in Europe—*S. Virgaurea* Linn.—; in Indo-China and Malaya—*S. Virgaurea* Linn.—; in North America—*S. canadensis* Linn., *S. californica* Nutt., *S. lepida* DC., *S. odora* Ait., *S. rigida* Linn., *S. sempervirens* Linn., *S. Virgaurea* Linn.—; in Brazil—*S. microglossa* DC.—.

Solidago Virgaurea Linn. is found in the temperate Himalaya from Kashmir eastwards at 5,000-9,000 ft., and in the Khasia Hills at 4,000-6,000 ft. It is distributed over Europe, temperate Asia and America, and Hongkong.

The plant is aromatic, stimulant, and carminative. It is astringent and diuretic, and efficacious for stone in the bladder. It allays sickness due to weak digestion.

In powder it is used for cicatrization of old ulcers. It has been recommended in many maladies, as it is a good diaphoretic in warm infusion, and is in this form also helpful in dysmenorrhoea and amenorrhoea.

As a spray and given internally, it is of great value in diphtheria.

Catalan: Vara d'or—; *Chinese*: Chi Nu, Lui Chi Mu—; *English*: Aaron's Rod, Banwort, Common Golden Rod, Golden Rod, Woundwort—; *French*: Herbe des Juifs, Verge d'or, Verge dorée—; *German*: Edelmindkraut, Goldenmundkraut, Goldenrautenkraut, Goldraute, Goldrute, Goldstengel, Gueldenwunderkraut, Gueldenwundkraut, Hainschwung, Heidnischwundkraut, Heilwundkraut, Klapperschlangenkraut, Nachtheil, Sankt Peterskraut, Sankt Petersstab, Stockschwungkraut, Stopfzu, Stoppkehrt, Stopploch, Wisselnkraut, Wunderkraut, Wundkraut—; *Indo-China*: Hoang Kam phuong, Nhat chi hoang hoa—; *Italian*: Erba pagana, Verga d'oro—; *Japanese*: Akino-kirinsô—; *Malaya*: Chec noo—; *Portuguese*: Vara d'oiro—; *Roumanian*: Splinuta de aur, Varga d'aur—; *Russian*: Solotoschnik—; *Spanish*: Vara de oro—; *Swedish*: Gulbris—.

SONCHUS.

The genus includes 45 species, natives of northern temperate regions and Central Asia, a few spread over the world with cultivation.

In Spain *S. arvensis* Linn., *S. asper* Hill., *S. crassifolius* Pourr., *S. maritimus* Linn., *S. oleraceus* Linn., *S. tenerrimus* Linn. are all used as emollients.

A. Annual
  1. Glabrous or sparsely glandular above ... 2. *S. asper.*
  2. Glabrous or sparsely glandular hispid ... ... 4. *S. oleraceus.*

B. Perennial
  1. Leaves runcinate-pinnatifid, spinous-toothed ... 1. *S. arvensis.*
  2. Leaves linear-oblong, quite entire or sparingly sinuate-toothed ... ... 3. *S. maritimus.*

1. **Sonchus arvensis** Linn. occurs throughout India, wild or cultivated, scarce in the plains, but more common on the hills where it ascends to 8,000 ft. in the Himalaya and the Khasia Hills. The

plant is found, wild or introduced, in all temperate and many tropical countries.

The plant is slightly bitter, diuretic; useful in chronic fevers, and in the treatment of the coughs in phthisis, bronchitis, asthma, and pertussis.

Among the Santals the root is given in jaundice.

Bengal: Banpalang—; *Ceylon*: Musalkatha, Poilaippillu—; *Hindi*: Sadhi, Sahadevibari—; *Punjab*: Bhangra, Kalabhangra—; *Santa*: Birbarangan, Birbarangom—; *Sinhalese*: Valdunkola—; *Telugu*: Nallatapata—; *Urdu*: Sahadevi—.

2. **Sonchus asper** Hill. is found throughout India, in fields and cultivated places, ascending to 12,000 ft. in the Himalaya. It occurs, wild or introduced, in all warm countries.

At Loralai the plant is pounded and applied to wounds or boils.

In Spain it is commonly used as an emollient.

La Reunion: Lastron piquant—; *Loralai*: Garwa, Machal—.

3. **Sonchus maritimus** Linn. is found in the Punjab and in Baluchistan, whence it extends westwards to the Atlantic.

In the Punjab it is used in the treatment of the coughs in phthisis, bronchitis, asthma, and pertussis.

Egypt: Libbeyn—.

4. **Sonchus oleraceus** Linn. is sparingly distributed throughout India and Ceylon; it ascends to 8,000 ft. in the Himalaya. It is found, wild or introduced, in all temperate and many tropical countries, in many varieties and forms.

An infusion of the root and leaves is used in Bengal as a tonic and febrifuge.

In Indo-China the stems are prescribed as a sedative and a tonic.

The plant is a popular laxative and diuretic in Italy.

The early Cape settlers applied the juice of the plant for cleansing and healing ulcers.

The brownish gum formed by evaporation of the common Sow-thistle, when taken internally in a dose of 2-4 grains, behaves as an 'intensely powerful hydragogue cathartic' and acts powerfully upon the liver, duodenum, and colon. In its general effects, it is said to most resemble elaterium, producing large and watery discharges so that it has proved a valuable therapeutic agent in ascites and hydrothorax. It requires, however, great care in its administration, since it has the disadvantage of griping like senna, and producing tenesmus like aloes.

The California Chinese use the juice as an anti-opium remedy.

Afrikaans: Melkdissel, Seidissel, Suidissel, Suigdissel—; *Antsianaka*: Beroberoka—; *Arabic*: Myrrejr—; *Betsileo*: Anamboraka—; *Bombay*: Mhatara—; *Brahui*: Aghud—; *Catalan*: Llacso, Lletso, Llicso, Llitso—; *Chagai*: Aghut—; *Chinese*: Ku Tsai—; *Egypt*: Besikh, Galail, Libbeyn, Qelawil, Tibsikh—; *English*: Du Tistel, Hare's Lettuce, Hare's Palace, Hare's Thistle, Milk Weed, Milk Thistle, Sow Thistle, Sprout Thistle, Turn Sole—; *French*: Labyrinthe étrille, Laceron, Laisseron, Lait d'âne, Laiteron, Laiteron commun, Laitron, Laitue de murailles, Lasseron, Liarge, Palais de lièvre—; *German*: Gaensedistel, Hasenkohl—; *Gippsland*: Thalaak—; *Hova*: Beroberokamboa—; *Indo-China*: Tuc doan—; *Iraq*: Murrair, Um-al-halib—; *Italian*: Cicerbita, Cicerchia, Crespignia, Crespignoli, Crispignolo, Sonca, Sparaghella—; *Kharan*: Gokizaban—; *Kotra*: Gogru—; *Languedoc*: Engraisso por, Lachassou, Lachenca, Lacheyroun—; *La Reunion*: Lastron doux, Lastron tendre—; *Malta*: Sow-thistle, Cicerbita, Crespino, Tfief—; *Mastung*: Agut—; *Mexican*: Chichicaquihuitl—; *Pacific Coast*: Annual Sow-thistle, Common Sow-thistle, Hare's Lettuce, Hare's Thistle, St. Mary's Seed, Sow-thistle—; *Patna*: Titaliya—; *Punjab*: Dodak—; *Roumanian*: Sussiu—; *Russian*: Zayatchiya kapusta—; *Spanish*: Camaroja, Cerraja, Lechecilla, Lechugilla—; *Suto*: Bono-sa-lekxwaba, Lesabe—; *Telugu*: Ratrinta—; *Uruguay*: Cerraja, Lechon—; *Yemen*: Myrreja—.

SPARGANOPHORUS.

The genus consists of only one species, **S. Vaillantii** DC., a native of tropical America, now a weed in Africa and Asia. It is found on the edges of ponds, rice-fields, and ditches throughout the Malay Peninsula.

It is used medicinally for headache by the natives of East Akim and Gold Coast.

Sierra Leone: Ewaruda—; *Yoruba*: Ewuro odo—.

SPHAERANTHUS.

The genus consists of 25 palaeotropical species.

S. senegalensis DC. is used medicinally in Mauritania, Gambia and Nigeria.

Glabrous or pubescent; branches with wings entire ... 1. *S. africanus.*
Tomentose or villous; branches with wings toothed ... 2. *S. indicus.*

1. **Sphaeranthus africanus** Linn. is common in swamps, in damp waste ground, and in mud, throughout the plains of Bengal and Sylhet, and southwards to Ceylon and Malacca, extending to the Malay Islands, the Philippines and Australia, China, Persia, and Africa.

The herb is stomachic and diuretic.

In Indo-China the plant is used as an emollient and resolvent; it is applied as a poultice to any dolorous part of the body. The juice of the leaves is used as a gargle in inflammation of the throat.

Indo-China: Bo xet, Bo xit, Chung vit, Cuu vit—; *Malaya*: Gelumak susu—.

2. **Sphaeranthus indicus** Linn. is common in the rice fields of India and Ceylon. In Tropical Himalaya it occurs from Kumaon to Sikkim, ascending to 5,000 ft. From Assam and Sylhet it spreads over the Malay Peninsula to Singapore, the Malay Archipelago, China, and Africa.

The plant is recognized by both Ayurved and Yunani systems of medicine.

The herb is a reputed general tonic, deobstruent, alterative and aphrodisiac.

The root and the seeds are considered as anthelmintic.

The powdered root is given as a tonic. The bark, ground and mixed with whey, is a valuable remedy for piles.

In the Punjab the flowers are highly esteemed as alterative, dipurative, cooling and tonic, In Java the plant is considered as a useful diuretic.

This small plant was used in the form of a decoction as a diuretic in urethritis. The result was unsatisfactory (Koman).

The rind of the fruit, dried and pounded, is used as a fish poison.

Among the Mundas the bruised plant is thrown into rivers and ponds to kill fish. It is stuffed into the holes of crabs to kill those animals. The plant is pounded with a little water, and the juice is expressed and used as a styptic. The juice of the fresh leaves, similarly obtained, is boiled with a little milk and sugar-candy, and drunk for cough.

On the Gambia the plant is gathered and spread thickly on beds on which sick persons are laid, to relieve pain and to induce sleep.

Arabic: Kamazariyus, Kamdaryus—; *Bengal*: Chagulnadi, Ghorkmundi, Murmuriya—; *Bombay*: Gorakhmundi, Mundi—; *Cutch*: Munderi—; *Deccan*: Mundhri, Mundi—; *Gambia*: Lookidge—; *Gujerati*: Bodiokalara, Gorakhamundi, Mundi—; *Hasada*: Najompuru, Paru—; *Hindi*: Gorakmundi, Mundi—; *Malayalam*: Adakkamanian, Attakkamanni, Mirangani—; *Marathi*: Barasavodi, Gorakhamundi—; *Mundari*: Kardanidudmuritasad, Kutunaara, Puru—; *Naguri*: Kardanidudumuritasad—; *Persian*: Kamaduriyus, Randarummitalkha—; *Porebunder*: Gorakhamundi—; *Punjab*: Gundhi, Gurukmundi, Khamadrus, Mundi, Mundibuti, Zakhmihaiyat—; *Sadani*: Khutlasag—; *Sanskrit*: Alambusha, Aruna, Avyatha, Bhikshu, Bhukadambika, Bhukanda, Bhutaghni, Boda, Chhitragranthika, Kadambapushpa, Kadambapushpika, Krodachuda, Kumbhala, Lochani, Lotani, Mahamundi, Mahashvranika, Mata, Mundakhya, Mundi, Mundirika, Nadikadamba, Nilakadambika, Palankasha, Parivraji, Pravrajita, Shravana, Shravanashirshika, Shravani, Sthavira, Tapasvini, Tapodhana, Vikacha, Vridha—; *Santal*: Belaunja—; *Sinhalese*: Etmadamahana, Mudamahana—; *Tagalog*: Sambonggala—; *Tamil*: Kottakkarandai—; *Telugu*: Bodasoram, Bodatarapu—; *Urdu*: Kamdaryus, Mundi—; *Uriya*: Buikadam, Murisa—.

SPILANTHES.

The genus includes 35 tropical species, mostly American.

Spilanthes Acmella Murr. occurs throughout India and Ceylon; it is found in all warm countries. It has been met with at an altitude of 5,000 ft. in the Himalaya and other mountains.

The whole plant is pungent to the taste, and the flower heads especially so, though when distilled with water these afford a distillate free from pungency.

The plant is used as a specific for toothache in Old Calabar. In South Africa the powdered leaf is placed in a carious tooth, and rubbed on the lips and gums for sore mouth in children.

The flower-heads are by far the most pungent part. They are chewed in India and Malaya to relieve toothache, which they do by producing redness of the gums and salivation. In Cameroons they are rubbed on the forehead for headache.

In Assam the plant is sometimes administered to women after childbirth. In Cameroons it is used in combination with others, chewed and swallowed, for snake bite, with local treatment of the wound.

Among the Mundas of Chota Nagpur the crushed plant is used as a fish poison. When in the rainy season, the children playing about in the water get their feet and legs covered with rash, they rub them with the leaves of this plant to soothe the itching. Poor people chew its seeds instead of pepper to provoke salivation when their mouth is dry.

In Indo-China the plant is boiled in water and the whole, liquid and solid, given in dysentery. In Ceylon the leaves and flowers are used for toothache and sore throat; they are also given to women at childbirth.

In the Philippine Islands a decoction of the root is given as a purgative. A decoction of the leaves is used as a bath in rheumatism, or as a lotion in scabies and psoriasis; the juice is considered vulnerary, as also the pounded leaves made into a poultice. Internally the decoction of the leaves is given as a diuretic and lithotriptic.

In Madagascar it is used as an antiscorbutic, diuretic, sialagogue, odontalgic, tonic, and digestive.

Dr. W. Farquhar has used and recommended a tincture of the flower-heads for toothache, in place of tincture of pyrethrum. He says it is a specific for inflammation of the periosteum of the jaws. A bit of lint, dipped in the tincture and laid on the gums, repeated three or four times a day, has a speedy effect in reducing the pain and swelling.

An active principle, *spilanthol*, with a local anaesthetic action, has been isolated from the flowers.

Ashanti: Nyamengen—; *Assam*: Pirazha—; *Awka*: Osana—; *Bakwiri*: Sekke—; *Betsileo*: Kimotodoha—; *Betsimisaraka*: Anamafana—; *Bombay*: Akarkara—; *Brazil*: Agriao do Para, Mastruco, Pimenteira do Para—; *Burma*: Henkala—; *English*: Toothache Plant—; *French*: Abéadaire, Abécédaire, Acmelle, Alcmelle, Cresson de l'Ile de France, Cresson des Indes, Herbe de Malacca—; *French Guiana*: Cressonpara—; *Hova*: Anamalaho, Anamalahokely, Anamalahombazalao, Anamalahoye—; *Ibo*: Osana—; *Indo-China*: Cuc ao, Ngo ao—; *La Reunion*: Acmella—; *Madagascar*: Cresson des Indes, Cresson du Para—; *Malay*: Gutang—; *Mauritius*: Acmella—; *Mundari*: Barandu, Birbiri, Bocotupuri, Cirbiri, Dudmuritasad, Hatukesari, Hatukisari, Kesari, Khesari, Marceia—; *Naguri*: Marcaia—; *Oloke-Meji*: Awere-pepe—; *Pampangan*: Palunag, Palunai—; *Punjab*: Akarkarha, Pokarmul—; *Russia*: Akmella—; *Sakalave*: Anamafana—; *Sinhalese*: Akmalla—; *Tagalog*: Hagonog, Hagonoi—; *Telugu*: Maratimogga, Maratitige—; *Uganda*: Tonjatula—; *Visayan*: Agonoi—; *Yoruba*: Awerepepe—.

var. **oleracea** C. B. Clarke (=*S. oleracea* Jacq.) is cultivated in gardens.

The whole plant is very acrid, but the flower-heads are especially so, having a hot, burning taste, which causes profuse salivation. They are considered a powerful stimulant and sialogogue, and used in headaches, paralysis of the tongue, affections of the throat and gums, and for toothache. A popular remedy for children who stammer.

In Madagascar it is considered to have the same therapeutic properties as *S. acmella* proper.

Bengal: Roshaniya—; *Betsileo*: Kimotodoha, Mangevitsa—; *Betsimisaraka*: Anamafana—; *Brazil*: Mastruco, Pimenteira do Para—; *Catalan*: Creixans del Para—; *English*: Brazil Cress, Para Cress—; *French*: Brède malgache, Cresson du Brésil, Cresson du Para—; *French Guiana*: Cresson-para—; *German*: Parakresse—; *Hova*: Anamalaho, Anamalahokely, Anamalahombazaho, Anamalahoye—; *Russian*: Brazilskiy Kress, Tsarskiy Kress—; *Sakalave*: Anamafana—; *Spanish*: Berros del Para, Espilanto—.

SYNEDRELLA.

The genus consists of 2 tropical American species, one also African and Asiatic.

Synedrella nodiflora Gaertn. occurs in cultivated places in Assam, Martaban, and the Andaman Islands. It is found in tropical Africa and America.

The leaves are boiled and used as a laxative by the natives of Gold Coast.

Ashanti: Kwadupo, Nkwadupor, Tutummirika kohwe epo—; *Timne*: Balkeyan-karuni—; *Yoruba*: Aluganbi, Zannaposo—.

TAGETES.

The genus includes 20 species, natives of warm America.

T. erecta Linn. is used medicinally in Mexico; *T. minuta* Linn. in Brazil; *T. pusilla* H. B. and K., and *T. zypaquinensis* Humb. and Bonpl. are used in Colombia.

Tagetes erecta Linn. is a native of Mexico, grown in Indian gardens.

The leaves are used as an application to boils and carbuncles; their juice is given in earache.

The flowers are employed in diseases of the eyes and for unhealthy ulcers, internally they are said to purify the blood; their juice is given as a remedy for bleeding piles.

Arabic: Hajai, Hamahama—; *Bengal*: Genda, Gendha—; *Bombay*: Guljajari, Makhmal—; *Brazil*: Cravo de defunto—; *Ceylon*: African marigold—; *Egypt*: Gatife—; *English*: African Marigold, French Marigold—; *Gujerati*: Guljharo, Makhamala—; *Hindi*: Genda, Gendha, Gulatora, Kalaga, Lalamuraga, Makhamali—; *Hova*: Anantsinahimbazaha, Tsipolobazaha—; *Iraq*: Ja'fari—; *Kathiawar*: Gulgoto—; *Marathi*: Makhamala, Rojiachaphul, Zendu—; *Mexico*: Cempoalxochitt—; *Nasirabad*: Gulgaindo—; *Persian*: Kajekharusa, Sadabarg—; *Punjab*: Genda, Mentok, Sadbargi, Tangla—; *Sanskrit*: Sthulapushpa, Zandu, Zanduka—; *Telugu*: Banti—; *Urdu*: Genda—; *Uriya*: Gendu—; *Yemen*: Naufar, Ranjes—.

TANACETUM.

The genus includes 30 species, found in the north temperate regions.

T. vulgare Linn. is used medicinally in Europe, and its flowerheads are officinal in Belgium and Portugal.

Leaves $\frac{1}{4}$-$\frac{1}{2}$ in. 1-2 pinnatisect ... ... 1. *T. fruticulosum.*
Leaves $\frac{1}{2}$-1 in. few scattered palmately 2-pinnatisect ... 2. *T. gracile.*

1. **Tanacetum fruticulosum** Ledeb. is found at 12,000-15,000 ft. in the Western Himalaya. It is also found in Baluchistan and Afghanistan, and in the Altai Mountains.

The herb is used as a tonic and anthelmintic. Soaked in cold water it makes a decoction which Baluchis consider very good for colds.

Baluchi: Drana—; *Brahui*: Butau, Drani, Jir—; *Kalat*: Butau—; *Noshki*: Drani—.

2. **Tanacetum gracile** Hook. fil. and Th. is found at 13,500 ft. in the Alpine Western Himalaya, from Kashmir to north of Kumaon. It also occurs in Baluchistan.

At Pab in Jhalawan the plant is considered as a cure for fevers.

Pab : Drane—.

TARAXACUM.

The genus includes 25 species, inhabiting temperate and cold regions.

T. officinale Wigg. is used medicinally in Europe, China and La Reunion. The whole herb or some of its parts are officially recognized in several countries: the dried plant in Japan; the root in Great Britain, Hungary, Sweden, Switzerland; the root and the dried plant in Russia; the root and the leaf in Austria; the leaf in France.

Taraxacum officinale Weber in Wigg. is found throughout the Himalaya and Western Tibet from 1,000 ft. up to 18,000 ft. It also occurs in the Mishmi Hills. The plant is almost cosmopolitan; it is at home in all parts of the north temperate zone, in pastures, meadows and on waste ground, and is so plentiful as to be a troublesome weed.

The plant is largely cultivated in India where the root is a very popular remedy for liver complaints.

The root is diuretic, tonic, and slightly aperient. It is a general stimulant to the system, but especially to the urinary organs, and is chiefly used in kidney and liver disorders. It is, perhaps, one of the most generally prescribed remedies in Europe.

At Kironi in Baluchistan the leaves are used for fomentations.

In China the leaves are prescribed internally as a bitter depurant, externally they are used for poulticing after having been pounded.

In Derbyshire, the juice of the stalk is applied to remove warts.

Baluchi : Halako—; *Bogotá* : Diente de león—; *Brahui* : Aghud, Bahi, Halako, Pochaku, Pochku—; *Catalan* : Angelets, Apagallums, Caixals de vella, Dents de lleo, Llitso d'asa, Pixallit, Pixallits, Xicoina de burro—; *Chinese* : P'u Kung Ying—; *Cornwall* : Dashelflower—; *Deccan* : Pathri—; *Devonshire* : Dashelflower—; *Dutch* : Paardenbloem—; *English* : Blowball, Dandelion, Milk Gowan, Pissabed, Priest's Crown, Swinesnout, Time-Table—; *French* : Chopine, Cochet, Couronne de moine, Dent de lion, Florion d'or, Laitue de chien, Liondent, Pissenlit, Salade de taupe, Tête de moine—; *German* : Ackerzichorie, Apostemkraut, Augenmilch, Baerenzahn, Bettpisser, Bettseiger, Bissanliwurzel, Butterblume, Eierblume, Feldreis, Gaddeliese, Habichtskraut, Hundslattich, Hundszahn. Jungeblume, Kuhblume, Kuhlattich, Laternen blume, Loewenzahn, Luchten, Maistoeckel, Milchadistel, Milchroedel, Milchstoeckel, Mistfinke. Moenchsblume, Moenchskopf, Papankraut, Pfaffendistel, Pfaffenoerhlein, Pfaffenschnell, Pfaffenstiel, Pfefferoeslein, Pferdeblume, Saumelke, Saustock, Seherrkraut, Schweineroesl, Schwiblume, Sommerdorn, Sonnenwirbel, Teufelsrippen, Tiefstand, Weglattich, Wiesenlattich, Zunehmkraut—; *Irish* : Cais tsearbhan—; *Italian* : Dente di leone, Smirnio, Soffione, Tarassaco—; *Kironi* : Gulsagh—; *Ladak* : Rasuk, Yamaghika—; *Languedoc* : Lagaina, Pissolet—; *La Reunion* : Chicorée sauvage, Pissenlit—; *Lepcha* : Ta-klok bi—; *Malta* : Dandelion, Dente di leone, Pisciacane, Tarassacio, Cicueira salvagga—; *Pacific Coast* : Blow-ball, Dandelion, Irish Daisy, Lion's-tooth, Puff-ball, Yellow Gowan—; *Portuguese* :

Dente de leaō, Taraxaco—; *Punjab*: Baran, Dudal, Dudhbattal, Dudli, Kanphul, Radam, Shamuke—; *Roumanian*: Papadie, Parasita gainelor—; *Russian*: Oduvanchik, Papovo gumentse—; *Sind*: Bathur, Buthur—; *Spanish*: Amargón, Cardillo, Dente de leon, Hocico de puerco, Tagarnina, Taraxacon—; *Tasmania*: English Dandelion—; *Uruguay*: Achicoria silvestre, Amargon, Diente de leon, Radicheta—.

TRAGOPOGON.

The genus includes about 24 species, natives of the Mediterranean region and Central Asia.

Peduncle much inflated under the head. Ligules purple ...	1. *T. porrifolium.*
Peduncle hardly thickened under the head. Ligules yellow	2. *T. pratense.*

1. **Tragopogon porrifolium** Linn. is found in cultivated places at Simla and in Western Tibet. It extends westwards to the Mediterranean.

Culpeper says of Purple Goat's Beard: 'The virtues of this are the same as the other, only less pleasant, therefore more bitter, astringent, detersive and medicinal. This, however, may be eaten in great quantities, and so will be useful in chronic complaints. The roots are particularly specific in obstructions of the gall and the jaundice; the best way to use them is stewed like chardoons.'

It ranks as one of the most salubrious of culinary vegetables, being antibilious, cooling, deobstruent, and slightly aperient.

The root is used in Spain as a diuretic, aperient, and pectoral.

English: Purple Goat's Beard, Salsafy, Salsify, Vegetable Oyster—; *French*: Barbebon, Salsifis blanc, Salsifis des jardins—; *Malta*: Salsify, Salsefica, Salsifi, Lehjet il botbot—; *Spanish*: Barba de cabra, Barbon, Salsifi blanca—.

2. **Tragopogon pratense** Linn. occurs in Western Tibet and the Western Himalaya, between 12,000 and 14,000 ft. It extends westwards to the Atlantic.

Culpeper tells us: 'A large double handful of the entire plant, roots, flowers and all, bruised and boiled and then strained with a little sweet oil, is an excellent clyster in most desperate cases of strangury or suppression of urine. A decoction of the roots is very good for the heart burn, loss of appetite, disorders of the breast and liver; expels sand and gravel, and even small stone. The roots dressed like parsnips with butter are good for cold, watery stomachs, boiled or cold, or eaten as a raw salad; they are grateful to the stomach, strengthen the lean and consumptive, or the weak after long sickness. The distilled water gives relief to pleurisy, stitches or pains in the side.'

The fresh juice of the young plant has been recommended as 'the best dissolvent of the bile, relieving the stomach without danger and without introducing into the blood an acrid, corrosive stimulant, as is frequently done by salts when employed for this purpose.'

In Italy the plant as a decoction is a home remedy for chest troubles and a popular sudorific.

In Spain the root is used as a diuretic, aperient, and pectoral.

Catalan: Barba de cabra, Barbata, Barbeta—; *Dutch*: Boksbaard—; *English*: Buck's Beard, Gait-berde, Goat's Beard, Go-to-bed-at-noon, Jack-by-the-hedge, John-go-to-bed-at-noon, Joseph's Flower, Nap-at-noon, Noon Flower, Noontide, Shepherd's Clock, Sleep-at-noon, Star of Jerusalem—; *French*: Barbe bleue, Barbe de bouc, Barbe de porc, Ratabout, Salsifis des prés, Salsifis sauvage—; *German*: Bocksbart, Ziegenbart—; *Italian*: Barba di becco—; *Roumanian*: Barba caprei, Barba popii, Barba tapului, Tita caprei—; *Spanish*: Barba cabruna, Barba de cabra, Barbajo, Barbon, Salsifi verdadera—.

TRICHOLEPIS.

The genus consists of 12 Indo-Malayan species.

Pappus absent ... ... 1. *T. angustifolia.*
Pappus short but conspicuous ... ... 2. *T. glaberrima.*

1. **Tricholepis angustifolia** DC. is found in the Western Peninsula, Canara, Mangalore, Travancore.

The plant is a bitter tonic and diuretic, used in cough.

Travancore: Utakatara—.

2. **Tricholepis glaberrima** DC. is common in western Rajputana, Central India, the Konkan, the Deccan, the South Maratha Country, the Western Ghats in the Bombay Presidency, South Canara, Coorg, and the hills of Mysore.

The plant is used in leucoderma and skin diseases, in inflammations. It is believed to be a nervine tonic and an aphrodisiac.

Bengal: Chhagaladandi, Vamanadandi—; *Bombay*: Motabor—; *Canarese*: Brahmadandi—; *Gujerati*: Brahmadandi, Phusiarun, Talakanto—; *Hindi*: Brahmadandi—; *Marathi*: Brahmadandi, Motachor—; *Sanskrit*: Ajadandi, Brahmadandi, Kantapatraphala—.

TUSSILAGO.

The genus consists of 1 species distributed over Asia, Europe, and North Africa.

Tussilago Farfara Linn. is found at 6,000-11,000 ft. in the Western Himalaya from Kashmir to Kumaon.

The Hindus consider that the leaves have the power of regulating the functions of the central and sympathetic nervous systems, and that they are valuable in the treatment of rheumatism; they also use the cotton-like down of the leaf as a styptic.

From the earliest times the plant has been esteemed useful in coughs and other pectoral affections. Hippocrates recommends the root with honey in ulcerations of the lungs. Dioscorides, Pliny, and Galen relate that the smoke of the leaves, received through a funnel or reed, is efficacious in coughs and dyspepsia.

Most of the Arabian and Persian medical writers describe the herb as bitter and carminative. The Yunanists use the roots and the leaves in chronic bronchitis, asthma, chest complaints, and inflammations; they are maturant and abortifacient.

Culpeper says: 'The fresh leaves, or juice, or syrup thereof, is good for a dry bad cough, or wheezing and shortness of breath. The dry leaves are best for those who have their rheums and distillations upon their lungs causing a cough: for which also the dried leaves taken as tobacco, or the root is very good. The distilled water hereof simply or with elder-flowers or nightshade is a singularly good remedy against all agues, to drink two oz. at a time and apply cloths wet therein to the head and stomach, which also does much good being applied to any hot swellings or inflammations. It helpeth St. Anthony's fire and burnings, and is singular good to take away wheals.'

Coltsfoot has been justly termed 'Nature's best herb for the lungs, and her most eminent thoracic'. The leaves are sometimes applied to wounds in Europe; and Sussex peasants esteem the white down of the leaves as a most valuable medicine. The dried leaves, when soaked out in warm water, will serve as an excellent emollient poultice.

In China the flowers are used as an expectorant in cough, asthma, apoplexy, and phthisis.

The leaves are officinal in Austria, Denmark, Germany, Norway, Portugal, Russia, Sweden, and Turkey. The flower heads are officinal in France.

Arabic: Ajanjiwun—; *Catalan*: Fills abâns que el pare, Pota de caball, Pota de cavall, Pota d'euga—; *Chinese*: K'uan Tung Hua—; *Danish*: Foeldfod, Hestehov—; *Dutch*: Hoefblad, Klein hoefblad—; *English*: Asse's Foot, Ass's-foot, Bull-foot, Bull's Foot, Clatter-clogs, Clayt, Clayweed, Colt, Colt Herb, Colt's-foot, Coughwort, Coutfit, Cowheave, Dishalaga, Donnhove, Dove-dock, Dummy Weed, Fieldhove, Foalfoot, Foal's Foot, Foalswort, Foilefoot, Hallfoot, Hogweed, Hoofs, Horse-hoof, Horse-hove, Son-before-the-Father, Sow Foot, Tunhoof, Tushalan, Tushylucky Gowan—; *French*: Chou de vigne, Filius ante patrem, Herbe aux pattes, Herbe de saint Guérin, Herbe de saint Quirin, Pas d'âne, Pas de cheval, Pas de poulain, Procheton, Racine de peste, Taconnet, Tussilage, Tussilage commun—; *German*: Ackerlattich, Auflattig, Berglaetsche, Brandlattich, Brandlatsche, Brustlattich, Derrelatten, Eselfuss, Eselhuf, Fahlenfuss, Feldlattich, Foelfod, Fuelifuess, Haberlattich, Haferlattich, Hoaflotcher, Huflattich, Hundblume, Hustenkraut, Kuhblume, Labaschen, Latten, Lehmblatt, Logjehn, Loedke, Maergabluemli, Negenkraftkraut, Pappenmuentz, Pferdehuf, Querniskraut, Rosshuf, Rosslattich, Sandblatt, Sandkraut, Sommertuerle, Weisslabeschen, Werschlabeschen, Zeitroeslein—; *Greek*: Bichion—; *Hindi*: Watapana—; *Italian*: Farfarello, Farfaro, Farfugio, Fayfaro, Unghia cavallina—; *Languedoc*: Pepoulit—; *Malaya*: Kuan tung hua, Toong fah, Tung hua—; *Norway*: Hestehof—; *Persian*: Fanjiwun—; *Portuguese*: Farfara, Tussilagem—; *Punjab*: Watpan—; *Roumanian*: Podbeal, Podbol—; *Russian*: Bielakopitnik—; *Spanish*: Pie de caballo, Uña de caballo, Tusilago—; *Swedish*: Haesthov, Haetshof—; *Urdu*: Fanjiwun—; *Yorkshire*: Cleats—.

VERNONIA.

The genus includes 650 species, chiefly tropical, and mostly American.

The following species are used medicinally in Indo-China—*V. cinerea* Less., *V. teres* Wall.—; in La Reunion—*V. cinerea* Less.—; in Madagascar—*V. appendiculata* Less., *V. pectoralis* Baker, *V. scariosa* Baker—; in Nigeria—*V. amygdalina* Del., *V. Kotschyana* Schultz, *V. nigritiana* Oliv. and Hiern.—; in Gold Coast—*V. amygdalina* Del., *V. Biafrae* Oliv. and Hiern., *V. conferta* Benth., *V. nigritiana* Oliv. and Hiern., *V. senegalensis* Less.—; in Guinea—*V. nigritiana* Oliv. and Hiern., *V. senegalensis* Less., *V. Thomsoniana* Oliv. and Hiern.—; in Gambia—*V. colorata* Drake, *V. nigritiana* Oliv. and Hiern., *V. senegalensis* Less.—; in Lagos—*V. cinerea* Less.—; in Sierra Leone—*V. amygdalina* Del., *V. nigritiana* Oliv. and Hiern.—; in St. Thomas—*V. amygdalina* Del.—; in Angola—*V. senegalensis* Less.—.

A. Achenes glabrous. Pappus white, outer hairs few ...	2. *V. elaeagnifolia.*
B. Achenes slightly narrowed at the base, clothed with appressed white hairs. Pappus white or dirty white, outer hairs very short	1. *V. cinerea.*
C. Achenes silky. Pappus yellowish or reddish, outer hairs few short caducous	4. *V. teres.*
D. Achenes sparsely hairy. Pappus dirty white or reddish, outer hairs often absent	3. *V. Roxburghii.*

1. **Vernonia cinerea** Less. is one of the commonest Indian weeds, occurring throughout India ascending to 8,000 ft. in the Himalaya, and in the Khasia and Peninsular hills. It is spread over tropical Asia, Africa, and Australia.

In the Nighantas the plant is described as cold, sweet, tonic, stomachic, astringent, and correcting all the humors; useful in the treatment of asthma, bronchitis, and consumption. The flowers are reputed to cure fevers.

The plant is used in decoction to promote perspiration in febrile conditions. The expressed juice is given in piles. In Senegal and French Guinea an infusion of the plant is used to wash a newborn infant, and is given also to children with incontinence of urine. The bitter root is a vermifuge.

The seeds are employed in Patna as an alexipharmic and anthelmintic, and as a constituent of masalas for horses. In Chota Nagpur, the whole plant is given as a remedy for spasm of the bladder and strangury; the flowers are administered for conjunctivitis; the root is given for dropsy.

In Ceylon it is used for wounds and sores, and taken internally to promote perspiration.

This plant is considered to possess strong diaphoretic properties, and is generally given by vaidyans to produce perspiration in fever. By itself, it has no antiperiodic property, but when combined with a small dose of quinine, it appears to help the action of the latter in malarial fevers. At Cannanore I found that one of the vaidyans there was treating cases of malarial fever with *V. cinerea* and 5 grs. of quinine made into a bolus with lime juice administered every morning. I tried this method in several cases and found it to be a useful combination (Koman).

Sushruta recommends the plants for the treatment of scorpion-sting; but it is not an antidote to scorpion venom (Caius and Mhaskar).

Bengal: Kalajira, Kukshim, Kuksim—; *Brahui*: Aghud—; *English*: Ash-coloured Fleabane—; *Ewe*: Osikonu—; *French*: Ayapana sauvage, Vernonia cendré—; *Gujerati*: Sadeori, Sadodi, Sedardi, Shedardi—; *Hindi*: Dandotpala, Sahadevi, Sadodi, Sadori—; *Indo-China*: Bac dau—; *Lagos*: Ewe jedijedi, Orungo—; *Malay*: Rumput sabagi, Rumput susor daun, Sembong hutan, Tahi babi, Tambak bukit, Tambak tambak—; *Malayalam*: Puvankuruntal—; *Malinke*: Kungueni—; *Marathi*: Sadodi, Sahadevi, Osari—; *Matheran*: Mothisardori, Sahadevi—; *Mauritius*: Ayapana sauvage—; *Merwara*: Kaliharr, Lalia—; *Mundari*: Toaara—; *Nasirabad*: Bhumbak—; *Oloke-Meji*: Elegbe oju—; *Porebunder*: Sadedi, Sadevi, Sadodi—; *Punjab*: Sahadevi—; *Sanskrit*: Dandotpala, Devasasha, Devi, Devika, Gandhavalli, Govandani, Saha, Sahadeva, Sahadevi, Vishamajvaranashini, Vishvadeva—; *Santal*: Bahututuri, Barangom, Birlopongarak, Duryaarak, Jhurjhuri—; *Sinhalese*: Monarakudumbia, Monerakudimbeya—; *Tamil*: Puvamkurundal, Sahadevi Sirashengalanir—; *Telugu*: Garitikamma, Gharitikamini—; *Timne*: Kubwo kerokani—; *Yoruba*: Bojure, Elegbe oju, Ewe jedijedi, Orungo—.

2. **Vernonia elaeagnifolia** DC. is found in Tenasserim and Pegu, extending to Siam and Indo-China.

In Cambodia the wood is used for troubles of the respiratory tract, more particularly of the nose. The wood is dried in the sun, finely scraped, and smoked with tobacco in the form of cigarettes. It is said to be very good for inflammation and ulceration of the mucous membrane.

Cambodia: Kanlak chak, Karleuk chak—.

3. **Vernonia Roxburghii** Less. is found in the Upper Gangetic Plain, Kumaon, Bengal, Burma, Central and Western India.

It is used as a substitute for *V. cinerea.*

Bonai: Banjatangi—; *Mundari*: Kutunaba—; *Santali*: Dorabohok'—; *Uriya*: Agnijal—.

4. **Vernonia teres** Wall. occurs in the tropical Himalaya from Kumaon to Sikkim, Bihar, Central India, Pegu, Burma, Indo-China.

A popular medicine in Annam for luxations, ulcers and wounds. It is given for dysmenorrhoea and dropsy. The flower-heads are considered ascaricidal.

Annam: Cay man tuoi, Trach lan thao—; *Quang-tri*: Cay muoi tuoi—; *Tongking*: Man tuoi—; *Vinh*: Co xanh—.

VOLUTARELLA.

The genus consists of 5 species, occurring from the Mediterranean to India.

Volutarella divaricata C. B. Clarke is found in the Punjab Plain, Central and South India, Baluchistan and Afghanistan.

The plant is credited with tonic, aperient and deobstruent properties. It is slightly mucilaginous and used in coughs. It is also used as a febrifuge, and often prescribed in fevers and general debility.

Arabic: Shaukat-el-baida—; *Bombay*: Badaward—; *Gujerati*: Badaward, Bhonyadandi—; *Hindi*: Badaward—; *Marathi*: Sakayi, Sukayi—; *Persian*: Asfar-e-bari, Badavard, Kangar-e-sufid—; *Syria*: Sanskhurda—; *Turkish*: Lufiniki—; *Urdu*: Badavarda—.

WEDELIA.

The genus includes 65 tropical and subtropical species.

Leaves subsessile, linear-oblong or oblanceolate, acute or obtuse, entire or subcrenate	1. *W. calendulacea.*
Leaves petioled, ovate-acuminate, serrate	2. *W. Wallichii.*

1. **Wedelia calendulacea** Less. is found in wet places throughout Bengal, Assam, Sylhet and Burma, the Konkan, the plains

districts of the Madras Presidency, and Ceylon. It is distributed to the Malay Archipelago, China and Japan.

In decoction the plant is used as a deobstruent, and is given in uterine haemorrhage and menorrhagia.

The leaves are considered tonic, alterative, and useful in cough, cephalalgia, skin diseases and alopecia.

An infusion of the plant is given in Indo-China for the swelling of the abdomen. In Annam the plant is used to prevent the effects of bad waters in the hill tracts.

Bengal: Bangra, Bhimraj, Kesaraja, Kesraj, Kesuria—; *Bombay*: Pivalabhangra—; *Chinese*: P'ang K'i Kiou—; *Deccan*: Pilabungra—; *Gujerati*: Bhangaro, Pilobhangro—; *Hindi*: Bhangra, Bhanra—; *Indo-China*: Hoa muc, Ngo nui, Tan sa—; *Marathi*: Pivalamaka—; *Sanskrit*: Bhringaraja, Devapriya, Haripriya, Harivesa, Kesaraja, Pavana, Pitabhringaraja, Pitabhringi, Svarnabhringara, Vandaniya—; *Sinhalese*: Ranvankikirindi—; *Tagalog*: Hagonay—; *Tamil*: Patalaikaiantagerai—.

2. **Wedelia Wallichii** Less. is found in the tropical Himalaya up to 5,000 ft., from Kumaon to Bhutan, the Khasia and the Mishmo Hills, Burma and Java.

In Assam the plant is said to heal wounds when applied to them.

XANTHIUM.

The genus includes 25 species, probably all of American origin. *X. spinosum* Linn. and *X. Strumarium* Linn. are used medicinally in Europe, North America, and Brazil; *X. canadense* Mill. is used in North America and Brazil; *X. Strumarium* Linn. in China, Indo-China, Malaya, and La Reunion.

Xanthium Strumarium Linn. is cosmopolitan in the warmer parts of the world. It is found throughout the hotter parts of India and Ceylon, usually near houses; ascending to 5,000 ft. in the Western Himalaya.

The root is a bitter tonic, useful in cancer and strumous diseases. The prickly fruit is considered cooling and demulcent and is given in small-pox. In Southern India, the prickly involucre is applied to the ear, or tied in bunch to the ear-ring, to cure hemicrania.

The whole plant is supposed to possess powerful diaphoretic and sedative properties. It is generally administered in the form of decoction, and is said to be very efficacious in long-standing cases of malarious fever.

In some parts of Germany the plant has a popular reputation as a remedy for ague, and in Russia it is considered to be a prophylactic in hydrophobia.

In China the burs are used as a tonic, diuretic, diaphoretic, and sedative.

The herb is used as an emollient and astringent in China and Indo-China. An extract of the root is applied to ulcers, boils, and abscesses.

In La Reunion the plant is considered bitter, astringent, antiscrofulous, and antiherpetic.

The leaves were formerly official in Europe and were administered internally in scrofula and in herpes.

In America and Australia, this plant has been observed to prove fatal to cattle and pigs.

Caius and Mhaskar have shown experimentally that the plant is not an antidote to either snake venom or scorpion venom.

Afrikaans : Boetebossie, Spitzklette—; *Assam* : Agara—; *Bengal* : Banokra—; *Bombay* : Shankeshvara—; *Brahui* : Bichudi—; *Burma* : Chosa, Koukpin—; *Catalan* : Bardana borda, Bardana menor, Escorpins, Llepassa borda, Llepassa menor, Rapalassa borda—; *Chinese* : Hsi Erh, Ts'ang Eul, Ts'ang N'i—; *Egypt* : Kharag-el-bahr, Shubhey—; *English* : Bur-weed, Clotbur, Cocklebur—; *French* : Glaiteron, Gleitron, Glèteron, Glouteron, Petit glouteron, Grappelles, Herbe aux écrouelles, Lambourde, Lampourde, Lampourde commune, Petite bardane—; *German* : Spitzklette—; *Gujerati* : Gadriyun—; *Hindi* : Banokra, Chhotagokhru, Chotadatura, Ghagra, Okura, Shankahuli—; *Indo-China* : Gi nhi, Ke, Ke dau ngha, Quyen nhi tu, Tuong nhi—; *Iraq* : Hasach, Lizzaij—; *Italian* : Lappola minore—; *Kashmir* : Lanetsuru, Tsur—; *La Reunion* : Grosse pagode—; *Malaya* : Buah anjang, Chong yee chee, Tsang ehr, Tsang yee—; *Marathi* : Dumundi, Dutundi, Sankeshwara—; *Pacific Coast* : Broad Cocklebur, Burweed, Button-bur, Bur Thistle, Common Cocklebur, Dike-bur, Lesser Burdock, Sea Burdock, Sheep-bur, Small Burdock—; *Punjab* : Chirru, Gokrakallan, Gudal, Jojre, Kuri, Sungtu, Wangantsuru—; *Pushtu* : Baggiari—; *Roumanian* : Scaietele-poppii—; *Sanskrit* : Arishta, Bhulagna, Chanda, Itara, Kambumalini, Kambupushpa, Kiriti, Malavinashini, Mangalyakusuma, Medhya, Pitapushpi, Raktapushpi, Sarpakshi, Shankhagalini, Shankhakusuma, Shankha puspi, Shankhavha, Shwetakusuma, Sukshmapatra, Supushpi, Vanamalini—; *Sind* : Gokhrukallan—; *South Africa* : Clotbur, Cocklebur, Noogoobur—; *Spanish* : Bardana menor—; *Tamil* : Marlumutta—; *Telugu* : Marulamatangi, Marulutige, Parsvapu, Veritallanappi, Talnoppi—; *Yemen* : Kavar el abid, Manj el ma—.

ADDENDUM.

E. IV. b.

4. Style-arms with long appendages. Achenes awnless ... *Chrysanthellum.*

CHRYSANTHELLUM

The genus consists of 4 tropical species.

Chrysanthellum indicum DC. is found in the Upper Gangetic Plains; Kumaon and Garhwal, at Hawalbagh and Naini-Tal, up to 4,000 feet; Nagpore. It is distributed to Madagascar and Tropical Africa.

The Mundas of Chota Nagpur bruise the leaves and rub them over aching heads; they miff the juice against headache. A piece of root is inserted into the hollow of a tooth to kill the maggot which is believed to live there and cause toothache.

Hasada : Peanggu—; *Naguri* : Piribaranggu—.

THE BIONOMICS OF THE YAM BEETLE [*GALERUCIDA BICOLOR* (Hope)] A PEST OF CULTIVATED YAM[1] IN S. INDIA.

BY

T. V. RAMAKRISHNA AYYAR, B.A., Ph.D.

(*With a plate*).

Though numerous species of Galerucine beetles have been noted till now from different parts of the Indian region, as far as the writer is aware, there is very little on record on the life histories and habits of the very common forms included under the well-known, large and widely distributed family Chrysomelidae. While we have some published notes on the life habits of several genera of the allied Hispine and Halticine groups, like *Haltica, Clitea, Longitarsus, Podontia, Hispa,* etc., our knowledge of the bionomics of the members of the Galerucine sub-family is unfortunately very limited. The information available so far in this direction pertains to only two or three species. These include Lefroy's[2] Notes on two species of *Galerucella* (*G. placida* B. & *G. birmanica* J.), life history notes on the red pumpkin beetle (*Aulacophora foveicollis* L.) first by Fletcher[3] and later on by Hussain and Shah[4], Khatib's paper[5] on the biology and life history of *G. birmanica* J., and Maulik's[6] recent description of the structural features of the mature larva of the beetles *'Oides bipunctata* F., and *Periclitena vigorsi* H. It is hoped that this short paper on another species of this group will add to our present knowledge of the bionomics of the Galerucinae. The insect which forms the subject of this paper appears not only to enjoy a very wide distribution all over India, but also to have attracted the attention of Entomologists from as early a date as 1899. But it is rather surprising to find that none of the recent workers on Indian insects—not even well-known official entomologists like Lefroy and Fletcher, have referred to this insect in any of their numerous publications. The writer noted this beetle for the first time in September 1921 in the Amalapur taluq of the Godavari District as a minor pest of cultivated yam (*Amorphophallus campanulatus*), and the first record of this insect as a crop pest is to be found in a short note in his paper on South Indian insects read before the fifth Entomological meeting at Pusa in 1923; since then it has been recorded on the same plant both by the writer and others, including Maulik, in parts of the Malabar District, and in the Cochin State. During the past season the author had some opportunities of studying the pest on his farm in South Malabar and the following is a brief summary of the observations so far made.

The insect, its distribution and *general organisation*:

Galerucida bicolor (Hope). This is a small active beetle, about 8 to 9 mm. long, belonging to the sub-family *Galerucinae* under the family Chrysomelidae. The general coloration is a pale reddish brown with dark spots or blotches on the elytra; there is a good deal of variation in the arrangement of these dark markings; in some, they are arranged in spots, and in others the spots

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[1] Paper read before the Entomological Section of the Indian Science Congress, Madras, January 1940.

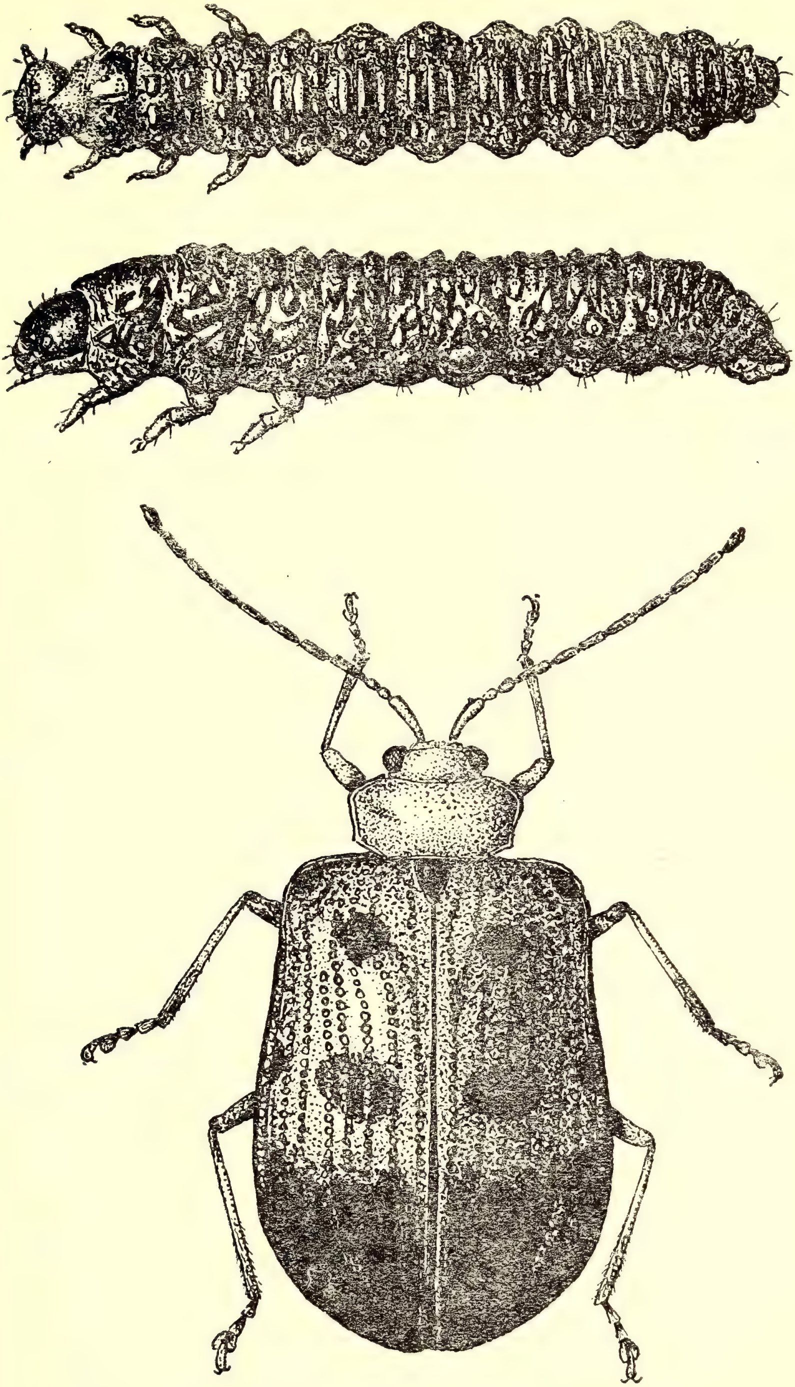
[2] Memoirs of the Deptt. of Agr. India, Ento. Series II p. 146 (1909).

[3] Rept. 2nd Ent. meeting Pusa, p. 302, (1917).

[4] Mem. Deptt. of Agr. of India, Ent. Series IX 4, (1926).

[5] Ind. Jl. of Agr. Science IV of 1934.

[6] Fauna of British India series—Galerucinae—pp. 26 & 34 (1936).



The Yam Beetle [*Galerucida bicolor* (*Hope*)]
(Grub and adult).

are fused and form elongate or broad blotches. Maulik gives three or four types in the arrangement of the black markings. The common types the writer has so far collected are the following: 1. Each elytron, with two round black spots on the basal area, one near the suture and the other near the humeral angle and then a large dark patch covering almost the whole of the hinder half of it. 2 as in 1 with the large dark patch broken up either completely into different roundish spots or 3.—entirely into roundish spots without any large patch. The distal segments of the antenna, the small scutellum and the tarsi of the legs are dark brown. Head distinct but narrower than prothorax which is covered by large shield and is more or less convex anterior to the middorsal region. Antenna medium sized with eleven segments. Elytra with longitudinal double rows of minute punctures. Maulik gives a detailed description of the adult. Though there are as many as 13 species recorded from different parts of India, *G. bicolor* H. is the only one so far noted from South India.

Life history :

Eggs are laid in clusters of about fifty or more just below the soil in the vicinity of the food plant; each egg is spherical and shining with the surface finely and smoothly sculptured. Hatching takes place in about two weeks. The early stage larva has the head, legs and prothorax shining black with the rest of the body pale yellowish; with each moult the grub develops a darker hue, and by the time it matures and approaches pupation it assumes a uniform shining black colour with the ventral side assuming a paler hue. In general form the full-grown larva is moderately elongate with the dorsal region flattish oval and the ventral side slightly concave. It measures 7 to 8 mm. in length. The head capsule is convex smooth and shining with a few short setae. The antennae which are minute are retractile though distinct; each of them rises from a broad basal piece and is one jointed bearing a fleshy sense cone. There is one ocellus on each side of the head. The prothoracic shield is a large single piece strongly chitinised and overlapping the head in front. Each of the following body segments is divided into many irregular regions by transverse and lateral grooves, and these areas are covered over by chitinous sclerites. The ninth abdominal segment is a single shieldlike plate like the head and prothorax and it almost covers the 10th (last) segment; this latter is in the form of a retractile many lobed fleshy sucker or pseudopod with the anus in the middle and this structure is used by the larva for safely fixing itself on any surface. The legs are distinct though small provided with pointed short claws; each leg has five joints including the claw. The thoracic and abdominal spiracles are minute and not clearly visible. The lateral regions of the body are provided with minute setae and hairs. Due to some difficulties in getting the larvae to develop under artificial conditions it has not been possible to make out definitely the actual number of larval stages; so far only three stages have been noted and the writer is not sure whether there are more than three instars. The larval period lasts from two weeks to 20 days. Pupation takes place just under the soil surface in oval earthen cocoons prepared by the grubs; occasionally the pupa is found naked in loose soil also. The pupa is 3 to 4 mm. long, short, broadly oval and curved anteriorly with the head touching the prosternum. It has a pale yellowish colour with wing pads and antennae pale, almost transparent. The body surface is fringed with transverse rows of short setae which are of a dirty brown colour; these are very conspicuous on the head and the abdominal segments where some of them arise from dark tubercles. The pupation period noted in captivity was from 12 to 15 days.

General habits :

The adult beetle feeds on the foliage of its food plant, the elephant yam (*Amorphophallus campanulatus*), by eating small holes characteristic of most leaf beetles. The grubs not only bite holes on the foliage but during their later stages completely skeletonise the leaves and start gnawing into the succulent leaf stalks and main stem. They feed gregariously, several being found together on each infested leaf or stalk. Badly infested plants are not only deprived of all foliage, but the stem and leaf stalks get riddled and the whole plant becomes covered with black patches of larval excreta. The grub when disturbed has the habit of curling up like cut worms. Besides yam, garden balsams are also attacked by both beetle and grub. No natural enemies of the grubs have been noted so far. However, when the mature grubs drop to the ground and wander about the soil before pupation some carabid beetles and centipedes have been found very partial to these grubs and it is perhaps not unlikely that there may be some closer relation between the two; for, Silvestri has recorded that a Galerucine beetle (*Galerucella luteola* M.) is the host of a parasitic Carabid beetle (*Labia scapularia* F.). Some of the sickly pupae collected from the soil were also found to be associated with minute round worms. These are most probably internal parasites on the beetle larva in view of the records by Cobb and others that many chrysomelid beetles harbour these nematode worms.

Incidence and seasonal habits :

The beetle starts breeding by about the outbreak of the South West monsoon, late in May or early in June when the yam crop is just rising from the soil and putting out tender shoots and leaves. The first generation of grubs appears on the food plant by the 2nd or 3rd week of June, and by about the middle of July they are fully fed and go into the soil to pupate. If the rains continue right up to the end of July we find another strong brood by the middle of August, after which the pest is not very much in evidence. It is very likely the adult hibernates during the subsequent months—this has not been properly verified as yet.

Economic status and control :

Though it becomes a fairly serious sporadic pest during certain favourable seasons and causes appreciable damage when the first generation is allowed to breed uninterrupted, it is easy to check the same by mechanical methods, especially in view of the gregarious habits of the larvae. Leaves containing numerous grubs feeding together can be easily hand-picked or shaken over a pan of water into which they easily drop. Hoeing of the soil around the plants in July will also help in destroying the underground pupae and prevent a further generation of the pest. It has not been found as a pest of any other cultivated crop as yet, though as stated before the beetle is found as a minor pest of garden balsams.

These notes are issued in view of the fact that this beetle appears to have some economic importance and there is nothing published so far on its bionomics.

ON THE ALTERATIONS IN THE TISSUES OF *MELOCHIA CORCHORIFOLIA* LINN. AND *CORCHORUS CAPSULARIS* LINN. ON A CHANGE OF ENVIRONMENT.

BY

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St. Xavier's College, Bombay.

(*With two plates and one text-figure*).

One of the most marked anatomical characters of aquatic and marsh plants is the existence of a highly developed system of air-chambers. The latter serve for ventilation and the storage of air, allowing a ready diffusion of gases for the submerged organs which are in water or badly-aerated, swampy soil. Such a lacunar tissue which has large air-spaces for ventilation and storage of gases is termed aerenchyma. Schenck (1889) restricts the term aerenchyma to the ventilating tissues of secondary origin which are homologous with cork; whilst Goebel (1891) and Haberlandt (1914) prefer to define the scope of the term from the ecological or anatomico-physiological standpoint. It has been recorded in several cases, that when parts of terrestrial plants grow in water or in water-logged soil, they develop internal air-chambers in the submerged parts or in portions growing in wet mud. Schenck (1889), Witte (1906), Gluck (1911), Batten (1918) and others have demonstrated the arising of aerenchyma in members of the Onagraceae, Lythraceae, Primulaceae, Leguminosae, etc.

Melochia corchorifolia Linn. and *Corchorus capsularis* Linn. are annuals found growing wild, in the Bombay Presidency, during the monsoon. As Saxton (1922) has pointed out, during heavy rains many low-lying areas get flooded, so that the plants growing in such places have to live under swamp conditions. Under the circumstances, only such individuals as are able to adapt themselves to living as marsh plants or helophytes survive. The two plants considered in this paper, start their lives as land plants. The individuals which are rooted on fairly well-drained soil continue to live as land-plants, while those which happen to be on low-lying, water-logged soil get easily adapted to living as marsh plants for the greater period of their lives. In order to study what particular factor in their anatomy helps the plants in successfully tiding over swamp conditions, apart from field observations, young plants of the same size were grown in pots under different habitats. Some specimens were allowed to grow as land plants, while others were submerged in water so that the root-system as well as about 20 cm. of the lower portion of the stem were under water. After nearly three months of immersion, the basal portions of the stems showed a remarkable change, both externally and internally, in which they differed from the stems of the plants growing on drained soil. As is the case with other marsh plants, noted by Schenck (1889), Goebel (1893) and others, the complementary tissue of the lenticels hypertrophy under water and protrude from the surface of the submerged stem in the form of white spongy masses. Within a week of immersion, fine much-branched, adventitious roots burst out in all directions from the submerged part of the stem. Such roots mostly remain free-floating, only a few entering the mud later on. The basal portion of the submerged stem has a distinctly wider girth than that of the land plants and the outer portion feels soft to the touch. For anatomical examination, sections at the same height on the stems of plants growing in water and on land were taken.

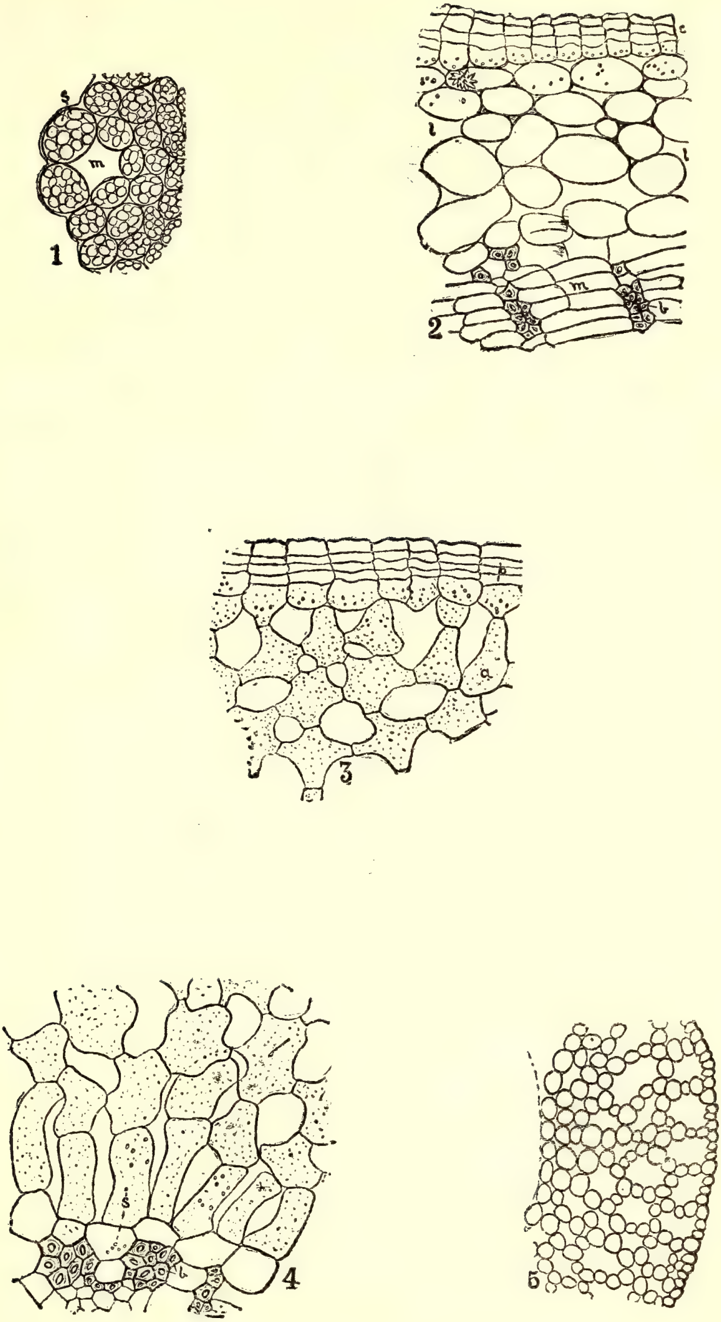
Melochia corchorifolia Linn., a member of the Sterculiaceae, is often found growing on the margin of fresh waters. Saxton (1924) has placed it in his synusium of typical helophytes and has figured a cross section of the stem, which appears to be that of the aerial part, but has not mentioned any structural peculiarities induced by submergence. In a young stem, the epidermis is followed by a 1-2 layered chlorenchyma. The outer cortex is composed of a three-layered, loosely-arranged more or less collenchymatous zone; while the inner cortex consists of large, thin-walled parenchyma. Medullary rays broaden outwards, in the region of the cambium, and form radial groups of large thin-walled, clear cells, separated by the bast portions of the vascular bundles. Mucilage-cavities, occurring in the cortex and in the outer pith, are schizogenous in origin (Fig. 1). In the cortex they arise in the thin-walled parenchyma, opposite the primary rays. As growth proceeds, the part of the cortical parenchyma around the mucilage cavities break down so that, in mature stems, large lysigenous spaces are formed in the cortex. The spaces occur, as a rule, opposite the rays and alternate with bridges of cortical parenchyma. Tanniniferous cells occur in the cortex, the medullary rays and the outer pith. The phellogen or cork cambium arises sub-epidermally and gives rise, towards the outer side, to a two-layered suberised tissue (Fig. 2).

In the case of the marsh form of the plant, the aerial part shows no change from that of the land form. From the water level downwards, however, the primary cortex of the stem becomes distinctly lacunar. The outer cortical cells stretch out in all directions forming more or less stellate cells which remain hanging together by their arms, enclosing prominent, schizogenously-formed air spaces (Fig. 3). The inner parenchymatous cells of the cortex also hypertrophy and stretch in various directions, the innermost cells having a tendency to elongate in a radial direction (Fig. 4). Thus after a time, the submerged part of the stem gets covered with a broad zone of soft, lacunar tissue which adds to its girth. In *Melochia corchorifolia,* the soft ventilating tissue, derived from the primary cortex, may thus be regarded as of the nature of aerenchyma which enables the plant to react in an advantageous way to the stimuli of an aquatic environment. At the water level, the outermost cells of the aeriferous tissue hold a few chloroplasts. The secondary wood is more porous and less lignified in the submerged part of the stem than in the land form.

The young roots of land forms have a cortex composed of 3-4 layers of comparatively large, thin-walled cells with small intercellular spaces. As the cork cambium arises in the pericycle, in the older roots the cortex peels off. In the marsh form the adventitious roots, arising on the submerged stem, show a contracted, tetrarch stele and a broad, lacunar cortex which resembles that of a typical marsh plant. The cortex is composed of a number of rounded cells with prominent air-spaces, arranged more or less radially (Fig. 5). The free-floating roots thus seem to serve mainly for aeration. In the old roots which enter the mud, the phellogen arises in the pericycle, as in the land form, and gives rise to cork on the outer side, as a result of which the lacunar cortex falls off. In such roots, the inner pericyclic cells develop wider air spaces than is the case in the land form.

Corchorus capsularis Linn., a member of the Tiliaceae, is another plant which has adopted an amphibious habit. As noted by Solereder (1908), in agreement with the close relationship of the Tiliaceae with the Sterculiaceae, the same anatomical features are found in *C. capsularis* as in the plant treated previously. The mucilage cavities occur in the parenchymatous zone of the cortex and in the outer pith. As in the previous plant, they are schizogenous in origin, but in mature stems, owing to the breaking down of the part of the parenchyma around each, they appear as lysigenous spaces separated by bridges of cortical parenchyma (Fig. 6). In the old stems, owing to the increase of the woody tissue and the destruction of the cortical parenchyma, the cortex appears as a narrow strip of tissue. The cork cambium arises sub-epidermally.

In the marsh form of *C. capsularis,* the aerial parts show the same structure as that of the land plant. Near the water level, however, the cortical cells get stretched in various directions and thus lead to the development of prominent, schizogenously-formed lacunae (Fig. 7). In the submerged stem, the cortical cells rapidly hypertrophy and form irregularly stellate cells which remain hanging by their arms (Figs. 8, 9). In the case of deeply submerged parts, even the outer pericyclic cells hypertrophy and add to the lacunar tissue. Thus, at times, the thin-walled cells on the inner side of the outermost group of bast fibres hypertrophy (Fig. 10). In the land form, this region is seen to be composed of closely-fitting, thin-walled, polygonal cells (Fig. 11). The phellogen layer of the submerged part gives rise to 1-2 layers of thin-walled, suberised cells towards the outer side (Fig. 8). Thus, as in the previous plant, the submerged stem of *C. capsularis* gives rise to a spongy, air-containing tissue, derived mainly from the primary cortex. In parts near the water line, the outer layers of this aeriferous tissue hold chloroplasts;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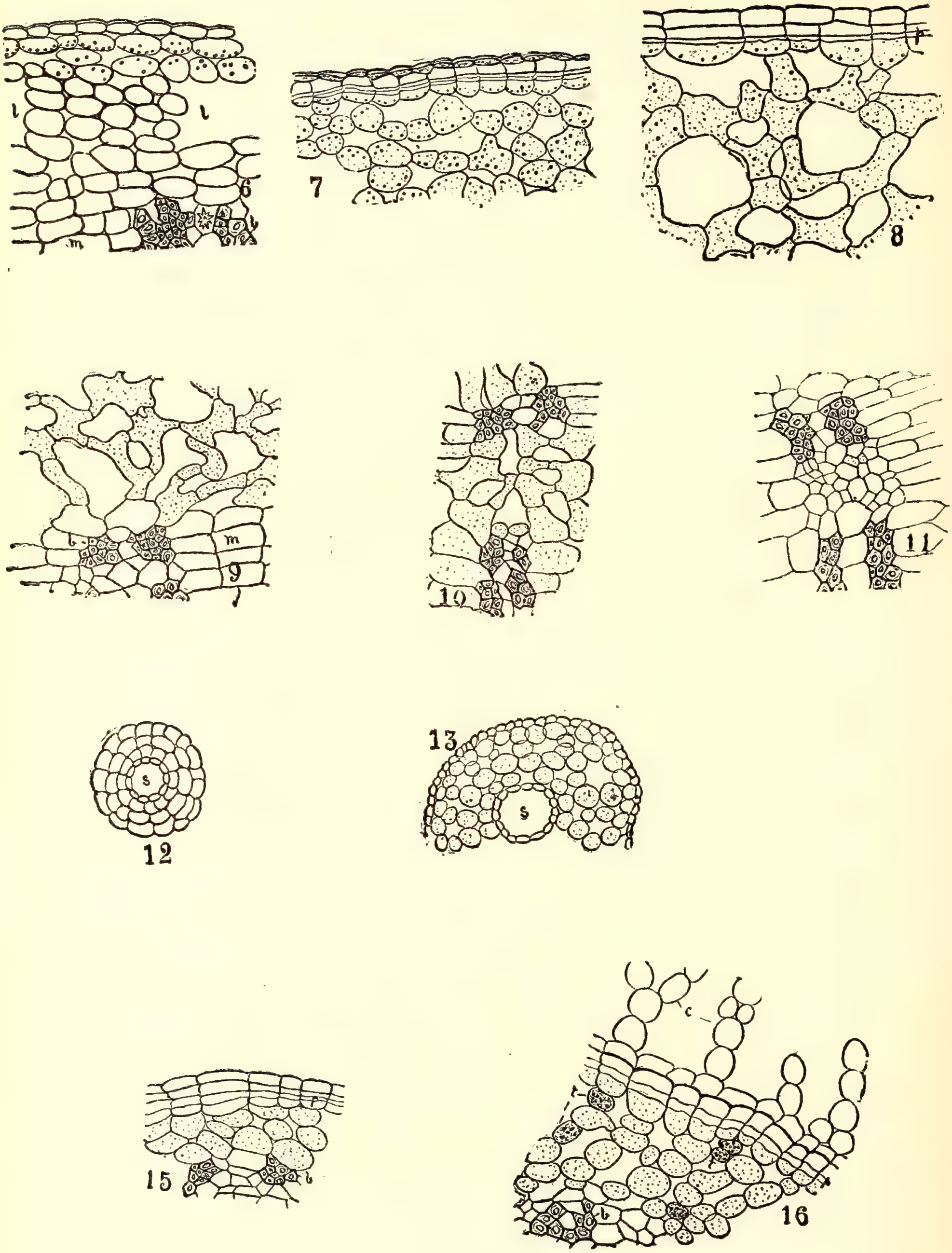
Melochia corchorifolia Linn.

For explanation see end of article.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Corchopus capsularis Linn.

For explanation see end of article.

while the inner cells remain clear. A few tanniniferous cells appear in the lacunar cortex. In comparison to the wood of the land form, that of the submerged part is soft, more porous, and feebly lignified. In plants submerged after secondary growth has started, the inner zone of xylem stands out as a more compact and lignified part, in contrast to the more porous wood formed after submergence.

The roots also show a resemblance to those of the previous plant. The cortex of the young roots of the land form is composed of 3-4 layers of large cells, with small intercellular spaces (Fig. 12). After secondary growth, a phellogen arises in the pericycle so that in the old roots the cortex peels off. In the marsh form, the young roots, buried in the wet soil, show a distinctly lacunar cortex (Fig. 13). As in the roots of aquatic and marsh plants, the aerating system of the floating roots is to be found in the primary cortex which is composed of rounded cells with more or less radially placed air-spaces (Fig. 14). The phellogen arises in the pericycle so that in old roots which enter the mud, the lacunar cortex falls off. In the land form, the inner pericyclic cells are more compactly arranged (Fig. 15), while in the submerged old roots of the marsh form they hypertrophy and give rise to a spongy tissue with prominent air-spaces (Fig. 16). Since the lacunar, primary cortex peels off after cork formation, this narrow strip of loosely-arranged cells, on the inner side of the pericycle, seems to help in the aeration of the older roots.

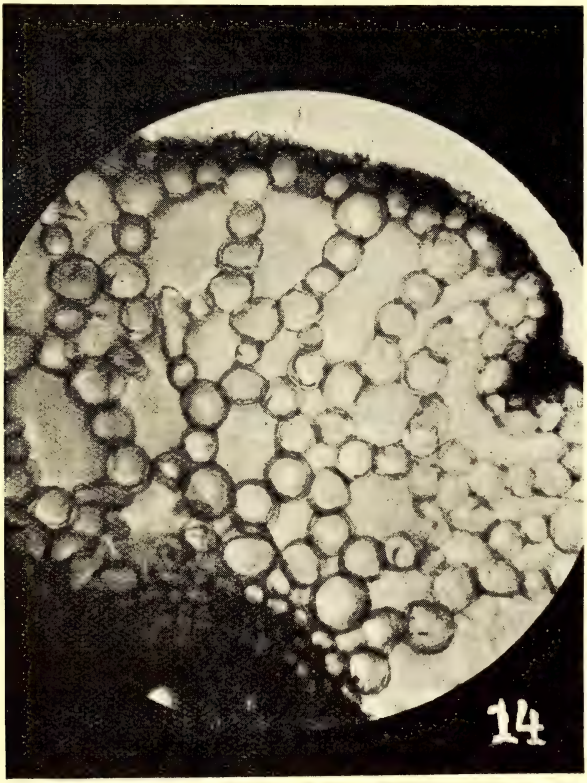

Fig. 14.—Photomicrograph. T. S. floating root, showing the cortical air-chambers (× 180).

A comparison of the basal regions of the stems of land and marsh forms of *Melochia corchorifolia* Linn. and *Corchorus capsularis* Linn. shows that even in the land forms there is a tendency for the outer cortex to be loosely-arranged. If such parts get submerged, the lacunae develop more vigorously, the cortical cells hypertrophy and form an aeriferous tissue. The roots arising under water also develop an aerenchyma of their own which is absent in the land form. This quick response, of the submerged stems and roots, to the aquatic *milieu* enables the plants to live successfully in a badly-aerated, water-logged substratum.

SUMMARY.

Melochia corchorifolia Linn. and *Corchorus capsularis* Linn. are found growing both under dry and swamp conditions.

In the marsh forms, the submerged part of the stem develops an aeriferous tissue derived mainly by the hypertrophy of the primary cortex.

The roots arising on the submerged stem develop a lacunar cortex, which adds to the aerating system of the submerged parts.

In the land forms the stems and roots lack such aeriferous tissues.

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EXPLANATION OF PLATES.

Plate I.

Figs. 1 to 5.—*Melochia corchorifolia* Linn.

Fig. 1.—T. S. stem, showing a mucilage cavity (*m*) in the pith; *s*, starch grains (x 150).

Fig. 2.—T. S. basal region of the stem of land form; *c*. cork; *l*, lysigenous space; *m*, medullary ray cells; *b*, bast fibres (x 240).

Fig. 3.—T. S. submerged stem, showing the outer cortical region; *p*, phellogen; *a*, aeriferous tissue (x 240).

Fig. 4.—T. S. stem, showing the inner aerenchyma; *b*, bast fibres; *s*, starch (x 240).

Fig. 5.—T. S. submerged root, showing the lacunar cortex (x 150).

Plate II.

Figs. 6 to 16.—*Corchorus capsularis* Linn.

Fig. 6.—T. S. mature stem of land form; *l*, lysigenous space; *b*, bast fibres; *m*, dilated ray cells (x 240).

Fig. 7.—T. S. submerged stem (at water level), showing the outer cortex (x 240).

Fig. 8.—T. S. submerged stem, showing the outer aerenchyma; *p*. phellogen (x 240).

Fig. 9.—T. S. submerged stem, showing the inner aerenchyma; *b*, bast fibres; *m*, medullary ray cells (x 240).

Fig. 10.—T. S. submerged stem (x 240). Explanation in the Text.

Fig. 11.—T. S. stem of land form (x 240). Explanation in the Text.

Fig. 12.—T. S. young root of the land form; *s*, stele (x 240).

Fig. 13.—T. S. young root of the marsh form; *s*, stele (x 240).

Fig. 14.—Photomicrograph. T. S. floating root, showing the cortical air-chambers (x 180).

Fig. 15.—T. S. old root of the land form; *p*, phellogen; *b*, bast fibres (x 240).

Fig. 16.—T. S. old submerged root; *c*, cortical cells; *p*, phellogen; *b*, bast fibres; *t*, tannin cells (x 240).

MISCELLANEOUS NOTES

I.—THE NUMBER OF TIGERS SHOT IN RESERVED FOREST IN INDIA AND BURMA DURING THE YEAR 1937-1938.

A question was recently raised by the editors of the *Encyclopædia Britannica* as to the number of Tigers shot annually in India and Burma. No recent records covering the whole area were available. The information published below was kindly supplied to the Society by the Chief Conservators of Forests with the various Provincial Governments and States and by the Game Warden, Burma. The data made available give the number of tigers shot by licence-holders in forests under the control of the Forest Department. It is compiled from the returns which the licence-holder is required to submit indicating the species and number of animals shot. The extent of demarcated forests in the various provinces is given. It should however be indicated that forests under Government control include forests where no tigers are found, or from which tigers have been long since exterminated. Statistics were not available from all the Indian States, but the list includes data from the major Indian States where tigers occur.

Number of tigers shot by licence-holders in Government-controlled forests in the British Provinces and Indian States in India during the year 1937-1938:—

Province or State.		*Area of controlled forest in square miles.*	*No. of Tigers Shot.*
Assam	...	6,429	18
Bengal	...	6,335	51
Behar	...	1,310	10
United Provinces	...	6,173	116
Cooch Behar	...	—	2
Indore	...	260	14
Gwalior	...	—	11
Rewa	...	—	39
Surguja	...	—	18
Orissa	...	2,118	19
Central Provinces and Berar		19,432	112
Bombay	...	10,819	34
Hyderabad State	...	546	18
Madras	...	15,124	19
Mysore	...	4,434	54
Nilgiris	...	—	5
		TOTAL ...	540

The figures given show the number of tigers actually shot in the reserved forests of India and Burma during the year 1937-1938. It should however be indicated that a fair number of tigers are also shot at and wounded and not recovered. The total casualties from shooting should therefore be taken at about 20% in excess of the recorded figures, because quite a number of tigers must die subsequently from bullet wounds. On this basis the total number killed might be estimated at approximately 650.

Tigers shot in areas outside control of the Forest Department.

Except from the province of Madras, no figures have been made available of the number of tigers shot outside demarcated forests. For the Province of Madras, Mr. C. C. Wilson, the Chief Conservator, very kindly obtained figures separately from the Revenue Department. For the year 1937-1938, they are as follows:—

Malabar	*S. Kanara*	*Coimbatore*	*Bellary*	*E. Godavery*	*Total*
37	7	1	1	5	51

The remaining districts of the province report *nil*.

It will be noted that the number of tigers shot in Malabar, i.e. 37, exceeds those for the whole of the Presidency. Mr. Wilson expresses doubt as to the correctness of the figure and believes that the number has been enhanced by the inclusion of panthers.

The data supplied give a total of 51 tigers killed during the year in the Province of Madras in forests outside the control of the Forest Department, as compared with 24 within controlled forests, inclusive of the Nilgiris. How far these comparative figures reflect the position in other provinces in India, one is unable to say. As regards the United Provinces, Mr. F. W. Champion writes : 'a limited number of tigers occur outside reserved forests and it is probable that an average of about 25 tigers are shot in areas outside the control of the Forest Department.' In Assam, the Conservator of Forests considers that the number of tigers shot outside reserved forests is certainly not less than within these forests. The number of tigers killed outside reserved forests would obviously add considerably to the total destroyed in reserved forests; but the figures made available provide reasonably accurate information as to the number of tigers shot within reserved forests, which in their extent cover about 1/3 of British India, and give interesting data for analysis.

Tigers shot in Controlled Forests.

Northern India.—Out of a total of 540 tigers accounted for in reserved forests in India, 197 were shot in the United Provinces, Bengal, Bihar and Assam. These Provinces together contain roughly 18,900 square miles of controlled forests in the greater part of which tigers are found. Out of the 197 reported killed, 116—by far the largest number—were killed in the United Provinces, which has about the same extent of controlled forest as Bengal or Assam, i.e. roughly 6,000 square miles, and in which, apparently, a larger number of tigers were slain than in any other province in India; including the Central Provinces, which come next and which, inclusive of Berar, has reserved forests covering some 19,000 square miles.

Mr. E. A. Smythies, Chief Conservator of Forests, U. P., has also given data covering the number of tigers shot annually over a period of 10 years. Between 1929 and 1939, 1,074 tigers were killed in the reserved forests of the United Provinces; the average number per year being 107·4. Since July 1931, except in the case of man-eaters, the payment of rewards by District Officers for the destruction of tigers in the U. P. has been stopped. The Chief Conservator of Forests adds that the discontinuance of the reward has had no effect on the number of tigers killed.

Despite the large number of tigers killed annually in the United Provinces Government Forests, the Chief Conservator of Forests considers that 'they are not being reduced in numbers, and in the vicinity of the Hailey National Park, tigers appear to have increased. Writing on this point Mr. F. W. Champion, Deputy Conservator of Forests says—'Considerable numbers are bred every year in the United Provinces forests, particularly in the Western Circle, whereas there is a tendency for Nepal tigers to migrate into the better stocked and fire protected forests of the Eastern Circle, which in Oudh march with the plains forests of Nepal. The recently formed Hailey National Park is also breeding many tigers which spread out beyond the boundaries of the Park. Altogether the position as regards the stock of tigers in the United Provinces is quite satisfactory and there is no known man-eater at the present time.'

Out of the 57 tigers killed in Bengal in the year 1939, Mr. W. Meiklejohn, Senior Conservator of Forests reports that 31 were shot in the Sundarbans division, comprising the civil districts of the 24 Parganas and Khulna: 'In that division the tigers are man-eaters and must be kept down to permit of the extraction of forest produce. Shooting is therefore encouraged and generally a reward of Rs. 100 per tiger is paid and sometimes in special cases the amount is raised to Rs. 150.' In the Northern Bengal division, the shooting of tigers is controlled by three Shooting and Fishing Clubs: no rewards are paid and two tigers are allowed per each permit per annum.

Rewards are paid for the destruction of tigers in Assam and in Bihar. The number of tigers killed in reserved forests in Assam during 1937-1938 was 18. Figures are not available for previous years. Mr. G. H. L. Marshall, who keeps the Game Register for the Naga Hills district, recently published a note (*Jour. B.N.H.S.*, Vol. xl, p. 740) giving a total of 59 tigers shot in this district over a period of 10 years (1927-1939).

The number of tigers shot in Cooch Behar State in 1937-1938 is given as 2. Data regarding the number of tigers shot in this State over a period of 27 years (1880-1907) are provided from the diary of H. H. the Maharaja of Cooch Behar, which is incorporated in his book, *Thirty-seven Years of Big Game Shooting*,

1908. In 27 years the total number of tigers killed in the State was 295:—90 between 1881-1890, 102 between 1891-1900, and 103 between 1901-1907. The average number per annum works out at 7·36: the highest number shot in any one year was 24 (1892) and the lowest 4. The last 7 years (1900-1907) showed the best average, which is 14·3.

Central India.

Coming to Central India, tiger shooting in most of the Central Indian States is a royal prerogative and therefore strictly controlled. In the 4 Central Indian States, i.e., Indore, Gwalior, Rewa and Surguja from which data were made available, 82 tigers were killed during the year 1937-1938. Some idea of the reduction in the number of tigers may be obtained from *Tiger Shooting in India,* written by Lt. William Rice, of the 25th Bombay Regiment, who in the year 1850 was stationed at Neemuch, Gwalior, C.I., where in the neighbouring jungles in one year he and his brother officers accounted for 98 tigers, killing 68 and wounding 30.

The most extensive area of controlled forests in India lie within the Central Provinces and Berar, where such forests cover 19,432 square miles. The total number of tigers killed within this area by licence-holders in 1937 was 112. No rewards are paid in the Province for shooting tigers except for the destruction of man-eaters and cattle-lifters. The number of tigers shot in 1929-1930 was 143, and in 1930-1931 was 118. After that year the number shot annually has varied between 105 and 130. The average for the last 5 years works out at 119·3. Mr. E. E. Cox, the Chief Conservator of Forests is of opinion that the stoppage of a general reward has had little apparent effect on the number of tigers killed. Conditions in the Central Provinces have considerably changed since Forsyth's days when conditions were somewhat parallel with what now obtains in the Sundarbans, and when it was the custom of the Forest Officers in the Betul District to spare a few weeks every year in the height of the hot season 'for the purpose of making an impression on the numerous tigers which at that time rendered working in the forests and carrying timbers so dreaded and consequently so costly to Government'. Between 500 and 600 human beings and an incalculable number of cattle were killed by wild beasts in the Central Provinces every year. Forsyth was of opinion that the heavy rewards offered for the killing of tigers and other dangerous animals contributed to their more rapid destruction: though he admitted that he had no statistics of the number killed during the years when no rewards were paid. In 1865 rewards were claimed in the Central Provinces for the killing of 1,863 tigers, panthers, bears and wolves, and in 1867 the number rose to 2,414.

In the Province of Orissa the total area of demarcated forests is limited to 2,118 square miles in which 19 tigers were shot. The average number for the last 3 years is 16. In controlled forests in Central India, covering the major Indian States and the British Province, the total number of tigers killed in 1937-1938 was 213.

Bombay Province and Hyderabad.

In the Bombay Province there are 10,819 square miles of demarcated forests: in much of this area tigers are not usually found or have long since been exterminated, Khandesh and Kanara being now the main strongholds. The total number killed within the Province in 1937-1938 was 34. The average number for the last 6 years was 37. Except in the case of man-eaters, no rewards are given for killing tigers.

The total area of reserved forest in Nizam's Dominions covers roughly 545 square miles. The total number of tigers killed within this area was 17. No rewards are paid within the State. The total number of tigers killed in controlled forests in the Bombay Province and Hyderabad State in 1937-1938 was 51.

Southern India.

The total area of demarcated forests in the Province of Madras in 1937-1938 was 15,124 square miles. Of this total 15,124 sq. miles represent reserved forests under the control of the Forest Department and the remainder reserved forests under the control of Panchayats, and reserved lands. As in the Province of Bombay, tigers are no longer found or have been exterminated from a large part of this area. The total number of tigers reported killed in these forests in the year 1937-1938 amounts to 19. Fortunately, from this province, figures are also available for areas outside the control of the Forest Department, which during that year amounted in all to 51; 37 of which were accounted for in the forests of Malabar which apparently contains the largest number. But as stated previously, doubts have been cast upon the correctness of this figure. South Kanara comes next with 7. Shooting of tigers within the reserved forests of the Nilgiri division is controlled by the Nilgiri Game Association, which is perhaps the most successful organization of its kind in the whole of India. In 1936-1937 the total number of tigers shot in the Nilgiris was 8; and in 1937-1938, 5. No rewards are paid for the shooting of tigers in the Nilgiri areas. In the Madras Province, a maximum reward of Rs. 50 is paid in 4 districts and Rs. 30 in other districts.

In Mysore State, tigers are listed as a 'game animal' and a licence has to be obtained for shooting them. Shooting is however not permitted in Tiger Preserves or in the Game Sanctuaries. Areas where tigers are reported by the District Magistrate to be causing 'havoc' to human life or to cattle, are thrown open to free shooting for such periods as may be considered necessary. The approximate area of forests in Mysore State is 4,434 square miles. The number of tigers shot, within this area in 1937-1938 is 54.

In Travancore State there are a little over 360 square miles of reserved forests and the number of tigers reported shot within the last 11 years is 8.

The total number of tigers killed in reserved forests in the Province of Madras and in Mysore is 81, of which 54 were accounted for in Mysore State. If the areas outside reserved forests are included, the total number reported killed in Southern India, i.e. Madras Province and Mysore, was 132.

Sex of tigers shot.

Details are available from a few provinces regarding the sex of the animals killed in the year 1937-1938:—

Assam	17 tigers	1 tigress
Bengal	40 ,,	11 tigresses
Behar	7 ,,	3 ,,
United Provinces	73 ,,	43 ,,
Bombay	23 ,,	11 ,,
Nilgiris	3 ,,	3 ,,

Out of the 195 animals shot in the Provinces of Northern India 137 were males and 58 females: the proportion of sexes working out roughly to 70 males to 30 females.

For the Bombay Province figures are available for the last 3 years: out of a total of 110 animals reported killed between the years 1936 and 1939, 72 were males and 38 females. The proportion of sexes for the 3 years working at is 65 : 34.

For Mysore State: out of 54 animals reported, killed, 50 were males and 4 females.

The figures everywhere reveal a great preponderance of males over females.

The data is interesting when brought into relation with a note published by Mr. R. C. Morris (*Jour. B.N.H.S.*, Vol. xxxiii, p. 972) in which he says that out of 16 tigers killed in the Coimbatore District in the last few years, 10 were tigresses and 6 were tigers. An excess of females over males is also shown in Mr. G. H. Marshall's note on tigers killed during 10 years (1927-1937) in the Naga Hills, Assam where out of a total of 59 animals, 27 were tigers and 32 tigresses.

Finally we have the data provided by the three censuses of tigers taken in the Game Range, Palamau Division, Bihar, by Mr. J. W. Nicholson, I.F.S., in 1934 and over the whole division by Mr. C. M. Chaudhri, Deputy Conservator of Forests, Bihar in 1936 and again in 1938. The data provided in all three censuses again shows a considerable preponderance of males over females. The tigers were enumerated as they came to drink at water holes. The time of the censuses was during the hot weather, and due precautions were taken to avoid error in the counting. Details of the system adopted and of the results will be found in Mr. Chaudhri's interesting paper (*Indian Forester*, Sept. 1938, p. 612). The results of the three Censuses may be tabulated as follows:—

Game Range, Palamau.

Year		*Total enumerated*	*Males*	*Females*
1934	...	32	22	10
1936	...	28	17	11
1938	...	18	12	6

The reduction in the total number counted in the year 1938 as compared with 1936 is ascribed to a fire which took place in one of the forest blocks, and to the block being thrown open to working, resulting in a migration of tigers into adjoining Zemindari jungle.

The data for the two censuses covering the whole division are as follows :—

Year		*Total enumerated*	*Males*	*Females*
1936	...	45	27	18
1938	...	29	19	10

Both Mr. Nicholson and Mr. Chaudhri comment on the low proportion of females to males.

It is difficult to draw conclusions from the data provided, but if the records available of tigers shot by licence-holders in reserved forests in British India are taken as an indication, then the forests of the United Provinces, in relation to their extent, contain easily the largest number; next comes the Central Provinces, then Bombay, and finally Madras where the number dwindles considerably except in the rain forests of the Malabar Coast and Mysore.

Commenting on the depletion of tigers in the forests of Southern India Mr. R. C. Morris writes—

'The chief cause of the disappearance of tigers in South India is, however, not in their destruction, but the killing-off of their natural source of food supply. There is not the slightest doubt to my mind that the wholesale slaughter of sambhur and chital by poachers and village licensees has affected the breeding of tiger detrimentally. In Sanderson's time the Chamarajanagar taluk of the Mysore District held a number of tigers; there are now none, or only an occasional wanderer. This is entirely due to the extermination of the deer in the Chamarajanagar forests, including the Chamarajanagar Game Sanctuary. As the deer were shot out the tiger left, and their numbers in the adjoining taluks of the Coimbatore District have decreased with the diminution of deer, continually harassed and shot as they are increasingly. The reason for the satisfactory position of tiger on the Nilgiris, and in the area under the control of the Nilgiri Game Association, is due to the fact that sambhur and chital abound in these parts. A poacher nowadays, sitting up over a water-hole, has no hesitation in shooting a tiger, should it turn up instead of a chital or sambhur. I do think however that a limit of a tiger per gun, per district, per annum should be imposed, as is now the rule in Mysore'.

The abolition of rewards for tiger has presumably little effect on the numbers destroyed as a dead tiger (like the Rhino) has a market price—the skin—the meat and the fat, are all in great demand, as also the clavicles, teeth and claws, all of which bring profit to the poacher. The rewards offer little or no incentive to sportsmen.

Secondly the data available suggests a predominance of males. Finally the payment or non-payment of rewards appears to have had little effect on the numbers killed. Thirdly stoppage of the rewards in the United Provinces, Central Provinces, and elsewhere has not been followed by any appreciable decline in the number of tigers killed.

Burma.

Reserved forests in Burma cover an incomparably greater area than in any province in India. There are 31,374 sq. miles of reserved forests. Throughout these forests tiger shooting is controlled under an 'unprotected game' licence which costs Rs. 10. In addition there are 'unclassed' forests covering 94,468 square miles. Here tigers may be shot without restriction. Much of this unclassed forest however contains no tiger. While in the reserved forests, according to the Game Warden, tigers are 'far more numerous than is generally appreciated'.

As regards Burma, Mr. F. H. Mustill, the Game Warden has favoured us with a statement showing the number of tigers reported shot during the last 10 years. In a period of 4 years, between 1928-1932, 1,382 tigers were reported shot: the average number per year being 365. The maximum number reported killed in any one year within this period being 492, and the minimum 201. The subsequent 6 years show an abrupt decrease in the number of tigers reported killed: the average dropping to 94 per annum, the figures for 1937-1938 being only 67, and the maximum being 182 and the minimum, 57. Mr. Mustill states that 'from September 1931 a general reward of Rs. 20 for each tiger shot was discontinued. Hence the figures from that date show considerable diminution and are in all probability unreliable'.

Mr. Mustill adds, 'My contention that the discontinuance of a general reward for shooting of Carnivora (which includes bear, leopard and wild dog, in addition to tiger) brought about considerable diminution in the number of tigers shot applies also to the other Carnivora:—

Year		*Leopard*	*Bear*	*Wild Dog*
1928-29	...	1,242	1,119	219
1929-30	...	829	1,018	210
1930-31	...	478	327	121
1931-32	...	615	307	107
1932-33	...	479	366	79
1933-34	...	539	408	87
1934-35	...	205	146	47
1935-36	...	30	30	8
1936-37	...	51	101	53
1937-38	...	38	209	66

The figures for Carnivora shot during 1935-36 had shrunk to such an extent that Divisional Forest Officers were specially asked to see that steps were taken to report all deaths of Carnivora. As seen from the above table some improvement in results has occurred but the figures nowadays in no way approach those for years previous to 1931. That this diminution in shooting of Carnivora is due in no way to diminution in stock is plainly evident from the numbers of tiger and wild dog especially which are to be found in the Burma Forests today.' The position appears to be at variance with what obtains in India where the discontinuance of payment of rewards in various provinces, as shown by the figures available, has had no appreciable effect on the number of tigers killed.

BOMBAY NATURAL HISTORY SOCIETY, S. H. PRATER,
April 15th, 1940. *Curator.*

II.—THE 'SAMBUR' CALL OF THE TIGER AND ITS EXPLANATION.

I hope the following will be of interest.

Early in April 1940 I was shooting with the Maharaj Kumar of Vizianagram in the jungles of the Maharani of Khairigarh in Lakhimpur Kheri, Oudh, and in the Nepal Tarai.

On the 6th I took my seat in a comfortable machan at about 5 p.m. in a thick and secluded part of the jungles on the Nepal border. Behind me was a small though thick tree and ringal clump and on the other sides was a sea of *narkul* and *ratwa* grass ranging from 2 to 20 feet in height. My object was not to shoot but watch wildlife and use my Cine-Kodak to the best advantage. At about 5-20 p.m. a tiger and a tigress came out of the *ratwa* grass into a clearing in front of me and about 150 yards away. At first they sat down to survey the country and then they started to gambol like a couple of overgrown kittens.

I was directly in their path and they would certainly have come past me, and given me a magnificent picture, when I saw the tigress stiffen her limbs and look in my direction a little to one side and towards the tree jungle. I felt certain she had not winded me. On looking back I found that one of my two look-out men, who had been placed in an improvised machan, was trying to scale another tree. I was naturally annoyed but could do nothing. However these preceedings were of considerable interest as by this time the tiger too was all attention and I heard and saw him utter the much-discussed 'sambar' call. From the way the tigers stared I was convinced that they had not made out what they had seen and, as they were uncertain whether it was friend or foe, they uttered this cry. Their expressions and attitude were a picture of suspicion mixed with a certain amount of alarm, and it struck me that the cry was also a cry of warning, for the tiger on uttering it promptly looked back at his mate who was a little behind him. After staring intently for another minute the pair turned round and disappeared from view.

In connection with this call I should like to narrate another incident which I experienced when shooting in the East Fen Block of the Mandla district, C. P., a few years ago. In a secluded part of thick jungle was a small pool very much used by wild animals. On three sides was thick jungle and on the fourth was a ridge about 4 feet high with rank grass and shrubbery, and beyond this was an open glade of grass. On the previous evening at about 5-30 p.m., while sitting on the ridge with two shikaris, we saw a tiger moving along in the thick jungle evidently on his evening prowl.

On the following evening we again repaired to the ridge and about 5-30 p.m. a large herd of pig entered the water and were snouting about in the weeds. After half an hour they jerked up their heads, listened intently looking towards the opposite bank, and then started to feed again though they appeared to be decidedly on the alert. Meantime we sat practically motionless smoking and chatting in whispers. One of the shikaris got up to hand me my binoculars when we heard the 'sambar' call from the direction in which the pig had been looking. The swine bolted and my friend and I did not in any way connect this with the call we had heard which I must confess we took to be that of a Sambar. However our shikaris were certain it was a tiger who, on suddenly noticing suspicious objects on the ridge, uttered the call in surprise and alarm and possibly as a warning. We saw no tiger but later verified from pug marks that one at least had passed along the jungle from where the sound had come. It seems to me that in both cases the 'Sambar' call was uttered as a note of sudden surprise or suspicion coupled with alarm and the instinct possibly to warn a mate close at hand.

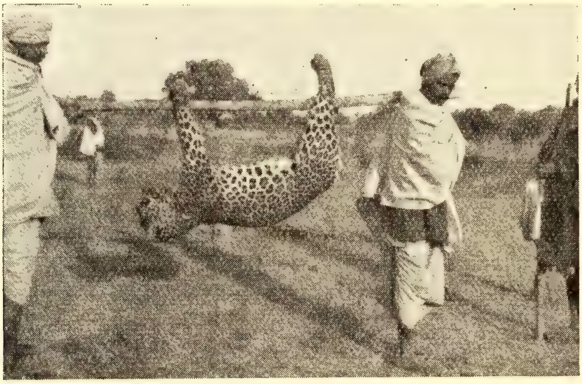
If you think this worth publishing in our *Journal* I shall be interested to see comments.

19, Rajpore Road,
Delhi.
April 24, 1940.

E. S. LEWIS.

III.—A TAIL-LESS PANTHER.

(*With a photo*).



A Tail-less Panther.

On the 18th-19th night of December 1939, I shot a panther at Amadeh Village, 15 miles from Pipariya, C. P. On examining the panther with two other British Officers we found it was completely 'tail-less'; there was not even a stump, and the panther showed no signs of a scar, or that the tail had been bitten or cut off. The panther, an old male, measured 4 ft. 10 in. from snout to the base of its spine.

D. RAMSAY BROWN,
Lieut.,
2nd Goorkhas,
1st Battalion.

FORT SANDEMAN,
February 16, 1940.

[In Vol. xxxvii, p. 719 of the Society's Journal we published a photograph of a tail-less tiger sent to us by Mr. R. C. Morris. —EDS.]

IV.—HYAENA CARRYING OFF A BEAR CUB.

'A bear provided an interesting experience. I had wandered down Sultan's Road (Talamalai) about eleven o'clock with Jeddia hoping to see a bear in the bright moonlight. Presently a bear came along and I fired at it. It ran off as hard as it could go, yelling and I thought I had missed; as it went, I let it have another or at least attempted to do so. As I fired I saw it had a baby riding like a jockey on its back in the usual bear way. It cleared right off. Presently I heard the calling of what sounded like a small bear from where the bears had disappeared. This was a second young one which had not been getting a ride when I fired at the mother. Presently there was a fiendish noise and I saw a hyaena tearing through the open, yelling or laughing or whatever you like to call it, and it picked up the little bear and carried it off before my eyes! In spite of the bright moonlight I could not get on to it quickly enough to fire and it ran into the jungle emitting a series of fiendish *giggles*—it could not laugh on account of the bear in its mouth! Next morning we found the dead mother bear and the jockey young one with it.'

[The above is an extract from a letter dated the 3rd April 1940 from Mr. H. E. Shortt, King Institute, Guindy, Madras, forwarded by Mr. R. C. Morris.—EDS.].

V.—ON JACKALS (*CANIS INDICUS*).

The following two incidents occurred when I was out with a party in the foot hills in the Ambala district.

(*a*) *Curious behaviour of a Jackal.*

We were having a jungle beaten for anything from panther downwards. I lay down with a friend on the bank of a *nallah,* and between the *nallah* and the jungle which was being beaten was a pool of water 20 ft × 20 ft. and about 6 in. deep. A game path led from the jungle to the water through which animals passed to cross the *nallah* into thinner scrub jungle. It was about 2 p.m. and I was lying with my hands under my chin, and staring towards the game path in the hopes of seeing the panther which was known to be there. Nothing nobler than a glabrous jackal, however, came out and entered the water without seeing me. When he was half way through I purposely made a slight movement which was at once detected. The beat could be heard some 200 yards away and, after a hurried glance back, the jackal to my surprise proceeded to submerge his head. He took it out after a few seconds for a breather and ducked again. After he had repeated this a few times we could not control a subdued laugh. This was too much for our friend who bolted back into the jungle now preferring to face the beat. It is obvious that he first considered himself between the devil and the deep sea and was so taken by surprise that he resorted to a silly subterfuge.

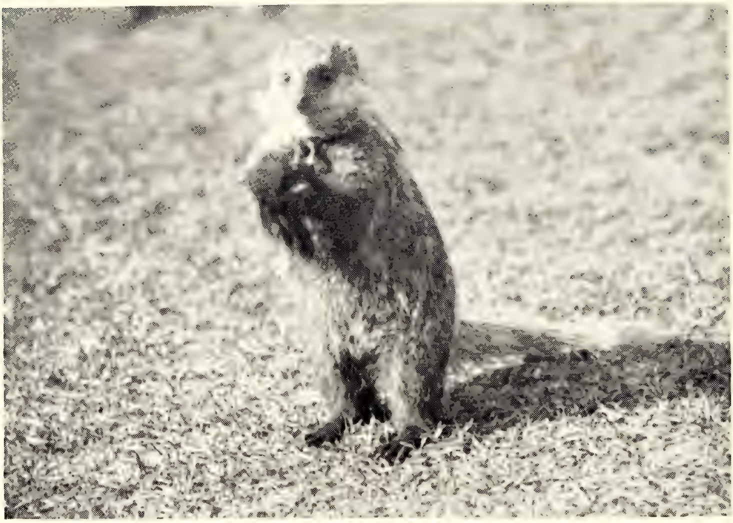
(*b*) *Jackals hunting hare.*

At the same place on another occasion I was lying down facing the scrub jungle at about 2-30 p.m. The open jungle consisted of interspersed thorn bushes and small clumps of sarkanda. I saw a jackal walk quietly upto a *sarkanda* clump and lie down against it in the shaded part. Then some 60 yards behind and to one side I saw a hare moving about and almost at the same moment caught sight of another jackal who moved slowly and apparently unconcernedly in such a way that the hare drew closer to the bush where the other jackal lay in ambush without movement. Within a few minutes the hare was hopping past the snare when he was knocked over and secured. I suppose that jackals, like wolves and wild dogs, work on carefully preconceived plans but this is the first time that I had occular proof of this.

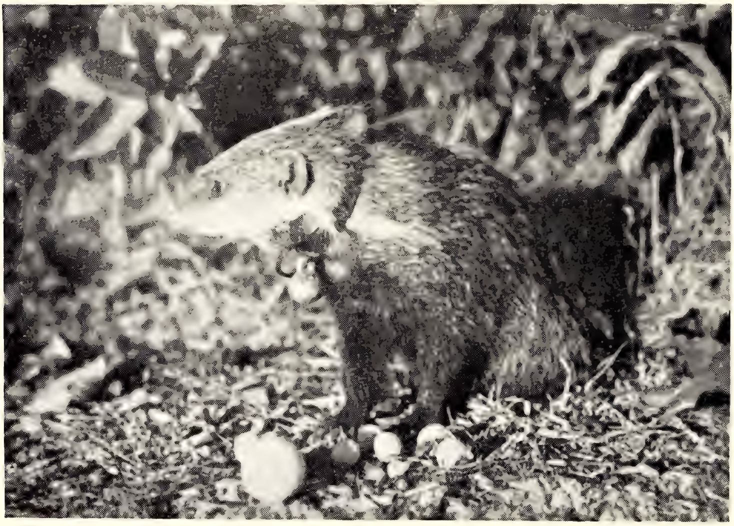
19, Rajpore Road,
Delhi,
March 24, 1940.

E. S. LEWIS.

[The jackal appears to have emulated the legendary behaviour of the ostrich in the sand. Unfortunately in crouching to escape observation—instinctive behaviour—he was compelled to have recourse to a less convenient element. As regards the tactics of Jackals in hunting the hare, there is a note in our *Journal,* by Mr. Salim A. Ali (Vol. xxxi, p. 812). There were two jackals, says Mr. Ali, but only one took part in the hunt—the other sneaking off when observed. There was no subterfuge in their hunting. The jackal went straight for the hare and kept at the chase in spite of being fired at twice and wounded with a charge of small shot. There is also an instance of two jackals attacking a spaniel (C. M. Inglis, Vol. xxxviii, p. 1122); one stood to engage the dog, the other coming up from behind tried to take it from the rear. Jackals, usually carrion-feeders, will hunt any small animal they can master and in their hunting they probably resort to methods sometimes adopted by the larger carnivores. The lion is known to drive its



He would take hold of a hard object in his hand and crash it down on the ground with great violence.



He was a friendly animal, allowed loose about the house.

THE CRAB-EATING MUNGOOSE.

Herpestes urva (Hodgs.).

quarry in the direction of the ambushed lioness and cubs, and tigers have been observed to follow the same strategy.—EDS.]

VI.—MONGOOSE ATTACKING A DONKEY.

We were duck-shooting last February about 20 miles from Delhi and were approaching water at about 11 a.m. About 200 yards away were two donkeys grazing in grass some 6 in. high. Suddenly one fell over and all we could see were legs kicking frantically in the air. We could not understand what had happened and so walked up to have a look. A huge slaty-coloured jungle mongoose (locally known as *jhund*) had seized the donkey by his snout and would not let go. A tap on the back with the butt end of a gun sent him scampering off and he was then shot. Is it a fact that donkeys are thus killed and is this usual? Surely prey of these dimensions is ordinarily beyond the killing capacity of a mongoose however big!

19, RAJPORE ROAD, E. S. LEWIS.
DELHI,
April 24, 1940.

[The mongoose can be a pugnacious and sanguinary creature, and may quite easily resent and punish disturbance by a blundering donkey; but we doubt whether it makes a practice of attacking donkeys, or is so ambitious as to want to kill and eat one.—EDS.]

VII.—THE CRAB-EATING MONGOOSE [*HERPESTES URVA* (*HODGS.*)] IN CAPTIVITY.

(*With a plate*).

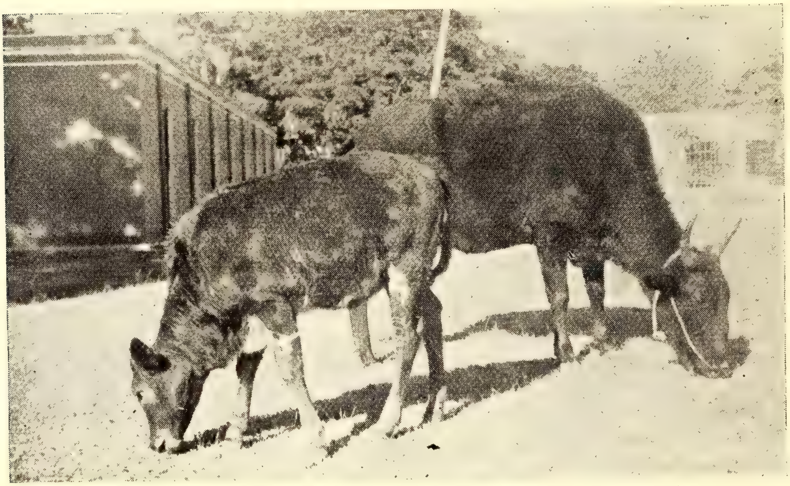
I send herewith four snaps of a pet Mongoose; perhaps you could let me know to what species he belongs as he is not the usual type of smaller mongoose. I am of opinion that he is an immature crab-eating mongoose, a specimen of which I sent you for identification from Tavoy last year. This little animal is extremely tame and is about four months old. He does not show much aptitude in dealing with live snakes, but is very keen on fish of all kinds.

He is a very friendly little animal and is allowed loose about the house. He spends much of his time feeling with his fore paws in crevices or under carpets apparently in the hope of finding a frog or snail concealed there. Another little trick he has, which I have tried to show in the accompanying photograph, is his habit of taking hold of any hard object, such as a stone or golf ball, and hold it in his fore paws and crash it down on the ground with great violence, so that it is flung behind him; at the time of impact he jumps so as to clear his hind legs of the missile. Photograph No. 1 shows him in the act of crashing a stone on the ground; in No. 2, he is apparently about to commence another throw. He prefers to carry out this game on a hard surface and I think in the natural state these animals use this method for opening shelfish. The force used in crashing the stone or other object on the ground is really astonishing and to stand behind him when he is playing this game on a hard surface may lead to a severe bruise on the shin. He spends most of his time feeling under stones and crevices with his paws from which I gather his main diet is frogs.

MOULMEIN, A. L'E. BROWNLOW,
January 11, 1940. *Dist. Supt. of Police.*

[The subject of the note is the Crab-eating Mongoose, *Herpestes urva,* which is found in the South Eastern Himalayas, Assam, Arakan, Pegu, and Tenasserim. Compared with other species of Mongoose it is exceptionally heavy in build, a character associated with its distinctive habits. Very little has been recorded about the habits of this animal. Blanford, quoting Hodgson, states that it is somewhat aquatic and lives chiefly on frogs and crabs which abound in the Himalayan and Burmese streams. The habit displayed by this mongoose of sitting up with any hard object in its hands and dashing it violently on the ground is probably an indication of its customary way of dealing with hard-shelled crabs and molluscs upon which it feeds. Like other species, it lives in holes in the ground. In this species, the anal glands are about the size of a cherry and the animal has the power of squirting out a foetid fluid from them backwards with great force.—EDS.]

VIII.—HYBRID AMERICAN BISON AND INDIAN DOMESTIC COW.



The enclosed photo of a cow and her young one may interest you. The cow is by an American bison from an ordinary cow.

Then she was served by a Watussi bull and the young one is the result. Also I am enclosing a separate photo of the young one.

SADEG Z. SHAH,
Assistant Secretary to His Highness
the Maharaja of Mysore, Mysore.

THE PALACE,
BANGALORE.
February 8, 1940.

IX.—WHALES IN BARODA, WITH NOTES ON THE ANATOMY OF THE FIN-WHALE (*BALAENOPTERA INDICA*) STRANDED AT MULVEL IN MARCH 1939.

Baroda City is somewhat inland, but the State has her seaboard both in Gujarat and Kathiawar: Okhamandal and Kodinar districts in the latter, and Navsari district in the former. The Kathiawar seas receive only a few rivers, like the Singoda or the Gomti, while in Gujarat as many as nine run through Baroda territory before emptying themselves in the Arabian Sea and its arm, the Gulf of Cambay. In these seas whales are not uncommon having been seen spouting, not only from steamers or fishing and other vessels but also from ashore, especially near Dwaraka and Muldwaraka.

The stranding of dead whales is, however, rare; for, so far, there are only three instances of the washing ashore of such carcases. The earliest on record was in 1879, when a 50 ft. whale came ashore at Dwaraka opposite the Political Officer's Bungalow and very nearly caused a pestilence. In 1883 a baby whale[1] 12 ft. long was cast up on the beach at Varvala near Dwaraka. Both were eventually cut up and buried in the sandy shore. A lot of the blubber was carried away by the Dheds who ate a portion of it and converted the remainder into oil by boiling it down. In 1919 a huge whale 71 feet long was washed ashore near Tithor up the Mahisagar river.

On the 21st March 1939 the pearlfishers working in the various bays near Mulvel in Okhamandal were scared by an amazing scene, a huge *Magar Machi* splashing, spouting and struggling in the Doribid bay. Apparently in its pursuit of food it had been carried along by the treacherous currents for which the Gulf of Cutch is notorious, till it suddenly found itself in the shallows of the Rann Bay; in its desperate efforts to escape, it became more and more incapacitated by the glairy mud, dangerous even to man, though the favourite haunts of the Placuna Pearl Oyster. It was indeed a ticklish problem to float the huge carcase which had sunk more than half in the mire and the solution involved no little trouble and time. Finally on the 25th the carcase was towed away to Okha by two Motor launches the 'Indira' and the 'Yaswant'. The body bore neither marks of damage nor any harpoon or other evidence of having been hunted. Another whale, which was stranded at about the same time, further south in the Arabian Sea, in the Bardez district of Goa, is said to have borne a harpoon.

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[1] In the course of a discussion, Mr. Dereniyagala, Director of Fisheries, Ceylon, expressed doubts about the identity of the animal as a whale because of the small size. The old records give the size, and call the animal a whale, but throw no further light on its zoological position.

Whales, with their pigmy cousins, the dolphins and the porpoises, are generally looked upon by fishermen as helpers in their vocation. For fish, in their terror at the approach of these giants, rush away as if blinded and are easily netted. Sometimes the dolphins damage the nets. When carcases of these aquatic monsters are washed ashore, villagers usually consider themselves lucky. In South India the belief is otherwise. Ananda Ranga Pillay in his famous Diary refers to a dead fish stranded in Pondicherry in 1757, 160 feet long and also mentions a smaller one 30 feet long driven ashore there 9 years previously and is sure that the giant forebodes disaster much greater than that ushered in when the smaller creature appeared. The Mulvel whale, after being taken to Port Okha, received offerings, floral mostly, from lady visitors who shared the general belief that the *Dev Massa* was the harbinger of prosperity and good luck. At Mulvel where the State is running a Pearl Fishery, the arrival of the whale spelt a loss as it stopped the fishery temporarily. Sharks[1], the terrible scavengers of the sea, gathered round the carcase and naturally the workers refused to go near the oyster beds. This was the main reason why the carcase was towed away to Port Okha where it was auctioned. As the whale was being cut up by the lessee, I availed myself of the opportunity to examine it and the notes and observations made are embodied in this preliminary report. Details regarding musculature, osteology, etc. will be published later.

The Mulvel whale identified as *Balaenoptera indica* measured 79 feet in length and 19 feet across. Its height was 6 feet. The width is more than what it should correctly be and the height much less, but that is due to postmortem changes. The head measured 18 feet. The flippers were 6 feet long. Each jaw measured 17 feet in length.

A characteristic of the genus is the plaiting of the skin of the throat and the undersurface and sides of the chest. The whale, when dead, usually turns on its back and so the telltale plaits on the throat and belly made identification simple. The dorsal fin which gives the animal its popular name 'the fin whale' was nothing but skin and blubber. The tail, which is extended horizontally and vertically had each fluke 9 feet in length. It was also composed of soft parts, skin and blubber. The general colour of the whale was said to be dark grey while the tail, the flippers and the underside were lighter.

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[1] Among the sharks which came to feast on the whale at Okha, one 11½ feet long was caught and auctioned.

The general public thought that the whale 'committed suicide' because she had swallowed treasure or something else equally disagreeable. The common belief is that the whale runs ashore to die, maddened by pain. An ancient rule in Britain makes all whales stranded or captured in the tidal waters the perquisites of the Sovereign, the king claiming the head and the queen the tail. Here the bones and stomach contents were reserved for Government and excluded from the sale. The vast quantity of matter in the inside of the whale created great surprise among the observers. The general idea entertained was that immediately an opening was made, the bowels, heart and other organs would be seen. Instead several hours were spent in cutting away the vast masses of flesh below the blubber and the viscera was not reached till later. The apparent hardness felt in the abdomen and which raised the hopes of treasure was because of the gases arising from the whale's last meal. The entrails on exposure disappointed every one and even disgusted those present, for so foul did the contents smell. The stomach contained in its chambers—four could be distinctly made out—mostly unrecognisable matter, but for the illdigested remains of fish. The intestines were very long and seemed to be full of little pouches.

The purchaser of the carcase bought it for the sake of the oil, which he extracted from the blubber and meat. The blubber was mere tissue, tough and fibrous, but containing a large amount of oil. It invested every part of the whale, but was thicker in some regions like near the back fin. The thin but tough dark skin covered a two-inch layer of yellowish-white fat beneath which lay the fibrous-textured blubber and then the reddish muscular tissue. Ligaments and tendons were broad and flat and yellowish-white in colour. While at Mulvel, volumes of blood were spouted up and the water all round about dyed red. Later, as the carcase was towed from Mulvel to Port Okha, a matter of 15 miles, it left a trail of blood and fat. The heart was a ponderous mass of flesh which quite filled a large drum. Blood-vessels were found to break up into 'retiamirabilia'. The brain was a huge mass, the cerebral hemispheres being much convoluted. It filled a bucket and weighed 7 lbs. There were 15 pairs of ribs the longest having the curvature measuring 15½ feet. The vertebrae totalled 63 and in the hinder part of the body had cartilaginous cushions between them. Two small curved bones were found embedded in the flesh near the reproductive opening; these apparently represent the pelvis. The specimen was apparently a female.

S. T. MOSES,

M.A., D.SC., F.Z.S., F.R.A.I.

X.—ANALYSIS OF A SALT LICK IN KOLLEGAL, COIMBATORE, S. INDIA.

I am enclosing a copy of the analysis of some salt-lick earth which the Director of the King Institute, Guindy (Col. Shortt) has had done for me.

I have always found this earth salty to the taste, which has not been the case with earth of game salt-licks I have tasted elsewhere. The earth was of a powdery nature, exuding in narrow belts on the face of the salt-lick, and ochre in colour. Fresh exudations of earth take the place of any removals. I may add that the previous sample of earth I sent in to the Society from this salt-lick was not of this exudation but merely of the salt-lick face, lighter in colour, and containing little or no sodium chloride.

The salty powdery earth now analysed was taken by me from the well-known Kottuguli salt-licks in the Kollegal taluk of the Coimbatore district. Herds of cattle are driven to the salt-licks annually from both the Kollegal and N. Coimbatore ranges and game animals visit the salt-licks extensively. Col. Shortt comments on the analysis as follows:—

'Only traces of the insoluble matter were soluble in dilute acid. The solution gave a reaction for iron and magnesium. The solution contained traces of aluminium and calcium salts. The absence of ammoniacal nitrogen would indicate that the chloride was not due to urine from the animals.

It is obvious from this that the sample contained quite a high percentage of sodium chloride which would easily account for the salt taste. This percentage is about twice that of sea-water. I believe this percentage of sodium chloride is much higher than is usually found in salt-licks. Samples previously tested by Father Caius have shown a chloride content of from 0.074 to 1·348 per cent.'

ANALYSIS.

Insoluble inorganic ...	74·2 per cent.
Sodium chloride ...	7·1 ,, ,,
Sodium sulphate ...	4·6 ,, ,,
Ammoniacal nitrogen ...	Practically absent.
Phosphate ...	Absent.
Organic matter ...	3·3 per cent.
Water ...	9·6 ,, ,,
Not accounted for (soluble) ...	1·2 ,, ,,
	100·0 ,, ,,

HONNAMETTI ESTATE,
ATTIKAN, MYSORE P.O.,
S. INDIA.
March 18, 1940.

R. C. MORRIS.

XI.—THE INDIAN BLACK EAGLE (*ICTINAËTUS MALAYANUS PERNIGER* HODGS.) IN SALSETTE.

In Mr. Ali's paper on the Birds of Bombay and Salsette a few doubtful records are given of the occurrence of this eagle in Salsette; a specimen was shot at Virar on Saturday the 14th January 1940 by Mr. G. B. Kotwal. The head and legs were sent to the Society. A second specimen was observed by Mr. C. McCann at Andheri on the 25th March 1940.

BOMBAY NAT. HIST. SOCIETY,
6, APOLLO STREET, BOMBAY.
April 16, 1940.

S. H. PRATER,
Curator.

XII.—EGGS OF YELLOW-WATTLED LAPWING [*LOBIPLUVIA MALABARICA* (*BODD.*)]

With reference to Stuart Baker's interesting note on what is known as the erythristic type of egg of this bird (*Journal;* vol. xxxv, p. 250), it may be of interest to record that I have a clutch of 2 eggs of this type taken near Mysore City on 9-6-36 and another clutch of 3 from Mavinhalla at the foot of the Northern slopes of the Nilgiris taken on 23-6-38. Both these localities provided eggs of the normal type also. Of a number of clutches found near Gundlupet in South Mysore all were of normal colouration except one which can best be described as a medial form between the normal and the red.

On p. 48 of vol. xl Mr. Betts also records the occurrence of the erythristic type in Coorg, so apparently its distribution is considerably wider than previously supposed.

KALHATTI,
NILGIRIS.
March 5, 1940.

E. G. PHYTHIAN-ADAMS,
Major I. A. Retired.

XIII.—PARTIAL ALBINISM IN A CHUKOR (*ALECTORIS GRAECA*).

(*With a photo*)

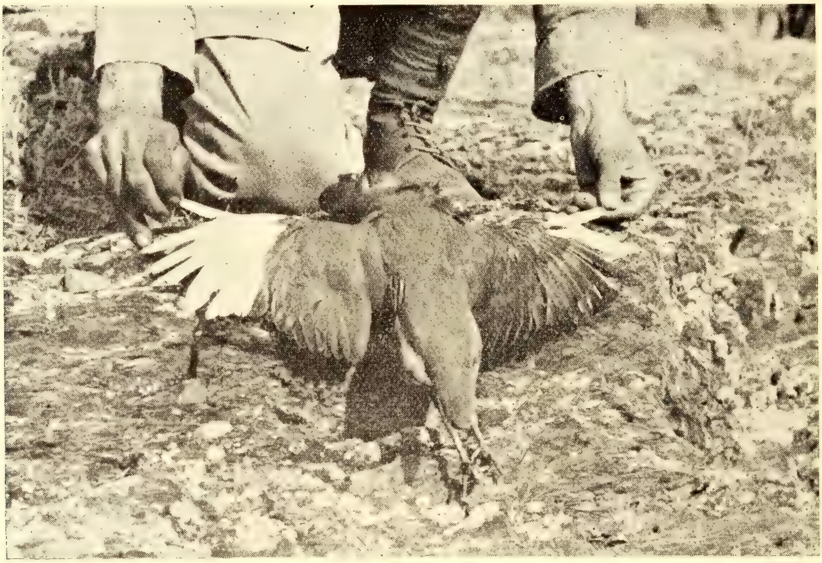
It may interest you to know that when shooting Chukor recently in Swat I shot rather an unusual Chukor which had white feathers on its wings as follows:—

Right wing—3 outer primaries pure white.
Left wing—9 outer primaries pure white.
Also some of the primary coverts.

There was also a large patch of white feathers on the upper breast, and some of the claws on both feet were yellowish white.

This bird got up three times and went forward in front of the guns before I eventually shot it and the tracer with me at once recognised it as a bird which they had seen on the same ground last year.

I took some photos of this bird which have not yet been developed; and I have skinned the left wing which I could send you if you are sufficiently interested.



I may add that the other three guns, all of whom have had great experience of chukor shooting, agreed that they had never seen a similar example of unusual colouring among chukor.

HEADQUARTERS,
PESHAWAR BRIGADE,
PESHAWAR.
February 16, 1940.

R. C. MACNAMARA,
Major.

XIV.—THE BRONZE-CAPPED TEAL (*EUNETTA FALCATA*) IN THE AMBALLA DISTRICT.

I thought that it might be of interest to your Society to record that on February 15th my wife shot a male Bronze-capped Teal (*Eunetta falcata*) on a hill some 20 miles north of Karnal. The bird was in company with a party of about 15 other duck which were taken to be Gadwall. One other bird was shot out of this party and at a quick glance was taken to be a female Gadwall; in view, however, of the close resemblance which the female Bronze-capped bears to the female Gadwall, it is possible that an error of identification occurred, and that the whole party were Bronze-capped Teal. The female was, unfortunately, given away and a more detailed examination was not possible.

Stuart Baker makes no reference to this Teal as a table bird, and the above-mentioned bird, which we ate this evening, was not first class being somewhat fishy in taste.

BUNGALOW 148,
AMBALA CANTT.,
PUNJAB.

R. C. NICHOLAS,
Major,
3rd Bn. 15th Punjab Regiment.

XV.—DOES THE COMMON WHISTLING TEAL HAVE MORE THAN ONE BROOD IN THE YEAR?

In looking through my Game Register, I find the following details which may be worthwhile placing on record. At Palasbani in the Kamrup District, Assam, on the 3rd November 1938, I was shooting duck and saw what I took to be a small group of nondescript-looking waterfowl swimming among the weeds; and as my boatmen asked me to shoot some of them for their evening meal, I fired and secured one. Much to my surprise the bird turned out to be a very young Common Whistling Teal (*Dendrocygna javanica*) which was still in down and quite unable to fly. There were a number of flights of mature birds of this species on the gheel I was shooting over; but this brood of youngsters I saw was unaccompanied by the parent birds who seemed to have left the young birds completely to their own devices. The brood could not have hatched before the middle of October which is surely very late in the year? It almost seems to indicate a second, if not a third brood.

SYLHET,
ASSAM.
January 24, 1940.

R. E. PARSONS,
F.R.E.S.,
Indian Police.

[The Common Whistling Teal commences to breed about the end of June. Most eggs are laid in July and August. The taking of young birds in down so late as November suggests either late breeding or the production of more than one brood which may occur when there is a superabundance of food supply.—EDS.]

XVI.—LATE STAY OF SNIPE.

Yesterday on a tank six miles from here I saw five common snipe and shot three of them. This is a fairly hot place and the first eleven days of April were the hottest of the month 103° to 105°; the middle of the month was cool but after the 19th the maximum reached 105° on three days. Is not the 3rd May very late for snipe to be found so far south? Ramdurg is 60 miles east of Belgaum. The birds I shot weighed 5 oz. each and were very fat.

RAMDURG,
S. M. COUNTRY.
May 4, 1940.

G. O'BRIEN,
Lt.-Colonel.

XVII.—MIGRATION OF WILD FOWL.

(*Continued from Vol. XL, p. 335*).

Place of Ringing	No.	Date of Ringing	Species	Ringed by	Place of Recovery	Date of Recovery
Ghana Keoladeo Bharatpur State, Rajputana.	4172	17-2-1939	The Common Teal. *Nettion crecca crecca* (Linn.).	Zahoorul Hassan.	Three miles from Kabul, Afghanistan.	11-3-1939
Lake Alakul (Kazakhstan, near the lake Balkhash), Moscow.	65765 D	July 1938	The Coot. *Fulica atra atra* (Linn.).	Central Bureau for Bird ringing. Moscow.	Hokra lake a distance of seven miles from Srinagar (Kashmir).	19-2-1939
North Kazakhstan on the lake Teten (54° 10′ N, 76°5′ E), Moscow.	54244 E	26-7-1937	The Garganey or Blue-winged Teal. *Querquedula querquedula* (Linn.). (Female)	Do.	Drig, Larkhana Dist. Sind.	1937
State Astrachan Preserve (Volga delta), Moscow.	13753 B	28-7-1938	The Indian Spoonbill. *Platalea leucorodia major* Temm. & Schleg.	Do.	Kolhapur State.	26-10-1938
Ghana Keoladeo Bharatpur State, Rajputana.	4200	23-2-1939	The Common Teal. *Nettion crecca crecca* (Linn.).	Kundanlal, Forest Circle Officer, Bharatpur.	Three miles from Chhatari, U.P.	30-1-1940

BOMBAY
March 1, 1940.

EDITORS.

XVIII.—MIGRATION OF WILD FOWL.

CORRIGENDA.

Vol. xxxiii, No. 4; p. 719.

For:—No. 43. 45 km. S. of Tara, lying N. of Omsk on River Irtysh 56° 44′N, 74° 17′E.
Read:—W. Siberia, near the mouth of the river Tara, affluent of the Irtysh, ca. 56° 30′N, 74° 40′E.

Vol. xxxiv, No. 2; p. 568.

For:—No. 3126. New Boukhara (Russia) ca. 40°N×70°E.
Read:—Uzbekistan, near the station Kangan.

Vol. xl, No. 2; p. 335.

For:—No. 3624. Kzyl-Orda (approx. 40° 45′N, 65° 30′E.)
Read.—W. Siberia, near the mouth of the river Tara, affluent of the Irtysh, ca. 56° 30′N, 74° 40′E.

XIX.—CROCODILE AND WILD BOAR.

A party of sportsmen, of which I was a member, was after partridge in the Ferozepur district of the Punjab close to the river Sutlej. At about 11 a.m. we put up a boar which made off in the direction of the river, and an hour later we got to the bank for lunch. We had barely sat down when the boar sneaked out of some bushes and took to the water making for a kikar tree about 100 yards in. He was swimming in water about 4 feet deep and had gone some 30 yards when a crocodile suddenly rose and faced him from about 10 yards. The boar immediately turned towards the bank when the crocodile showed himself between him and the bank. These tactics were repeated two or three times when the boar, which was exhausted with his effort and loss of blood, suddenly disappeared having doubtless been pulled under by his antagonist. Has any one else seen anything akin to this? The crocodile must have been lying up close by and doubtless discovered the condition of the boar as the water was considerably stained with blood.

19, RAJPORE ROAD, E. S. LEWIS.
DELHI.
April 24, 1940.

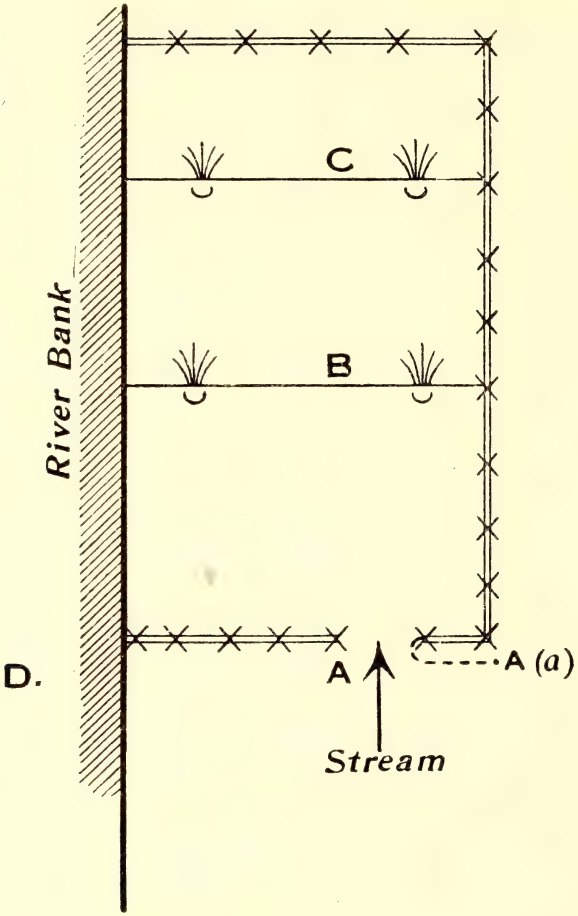
XX.—AN INGENIOUS FISH TRAP.

(*With a diagram*).

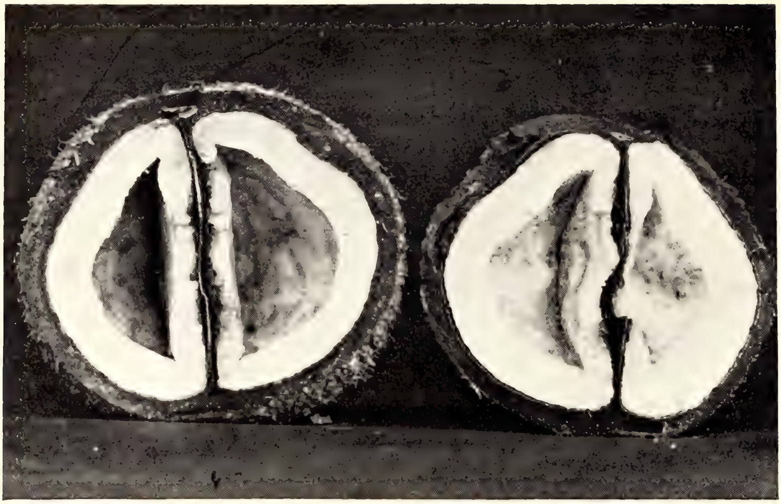
I enclose a diagram with explanation of a very cunning fish trap which is used a certain amount in the Shan States.

For all I know it may be used in India too although I have never seen one myself exactly similar to it.

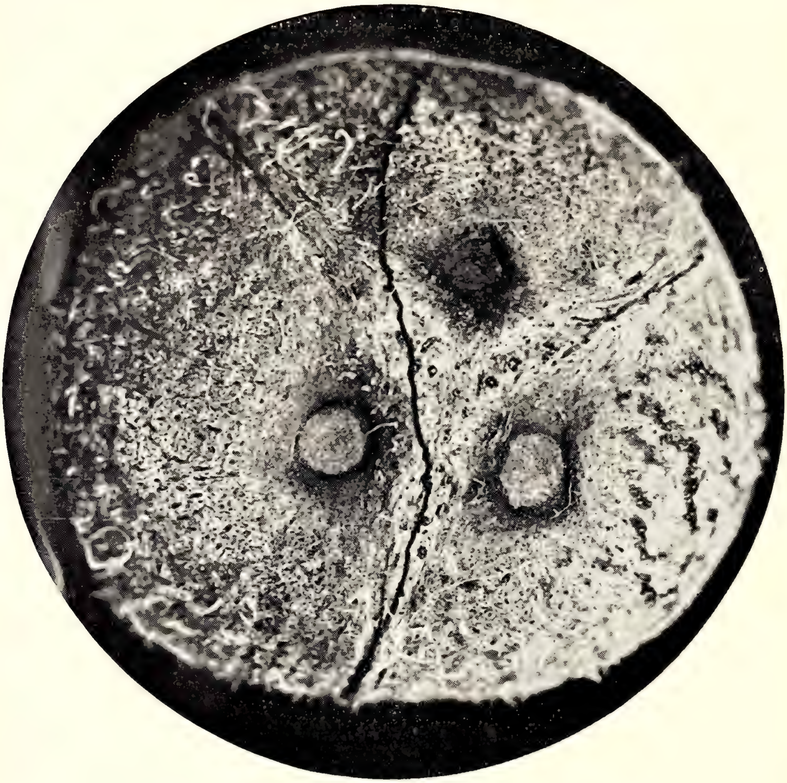
It consists of a bamboo fence (the strips of bamboo being very close together) forming three sides of a rectangle—the fourth side being the river bank. The area of the rectangle is about 12 square yards. The bamboo fence is about four feet high and, being in shallow water, a certain amount of it protrudes out of the water—the remainder of course being underneath the water with the bottom of the fence on the bed of the river.



At point A (see diagram) there is a gap, some four feet across, made by rolling back four feet of bamboo fence to one side (point Aa). At points B and C there are lengths of ordinary string tied across from the bamboo fence on one side to the river bank on the other. Height about the same as the water level. Tied on to these lengths of string are two or three bundles of a certain green weed which is met with in this country and has a



Bi-cellular coconut (*Cocos nucifera* L.) showing the septum.



Bi-cellular coconut showing the two enlarged 'eyes'.

little red flower. Actually the bundles of weed used for this purpose have buds which have not yet flowered.

In order to prevent these lengths of string from sagging due to the weight of the weed bundles pieces of string are tied on to them and stretched to the river bank (which is sloping) and fastened on to some root or tree. (I have not marked these in the diagram).

Now the system on which this trap works is simplicity itself but it is nevertheless a cunning idea.

The fish enter the enclosure at point A (which is of course at the downstream side of the enclosure). They go up to feed at points B and C. When there are sufficient fish inside the door, Aa is pulled over the gap by a string attached to it and operated by a man who hides behind a mass of undergrowth at point D.

Fishing with rod and line is disappointing in the Shan States and although there are mahseer they will not look at artificial bait.

BURMESE FRONTIER FORCE,
LASHIO, N. SHAN STATES.
January 31, 1940.

A. G. SANDEMAN,
Lt.

XXI.—MIGRATION OF BUTTERFLIES.

I have to record the following instance of a migratory flight of butterflies :—

'*Catopsilia crocale.* 16 July, 39. Near Ranikhet (Kumaon). Flying to west against slight wind. Approx. two butterflies in a breadth of 100 yards per minute.'

I watched the flight for about 1½ hours, but cannot say for how long it lasted. I caught three specimens (two ♀ one ♂). I cannot send them as I have the wings only mounted behind celophane on cards. There is no doubt as to the identity of the species.

STAFF COLLEGE,
QUETTA.
April 29, 1940.

J. H. B. LOWE,
Major R. E.

XXII.—A BI-CELLULAR COCONUT (*COCOS NUCIFERA* L.)

(*With a plate*).

The ovary of the coconut has 3 cells, two of which become abortive and only one develops. In rare instances two-celled coconuts are met with. In this there are within the single outer covering two chambers separated by a thin septum of endocarp. Each of these chambers has its own endosperm and embryo. Of the three 'eyes' on the endocarp, the two, corresponding to the fully developed cells, are large and soft, while the third, corresponding to the undeveloped cell is small and hard. If this coconut had been planted two seedlings would have been produced.

Photo 1. Cross section of the nut showing the two cells with a thin shell separating the two endosperms.

Photo 2. Showing two enlarged soft 'eyes' corresponding to the two cells, while the third remains small and hard.

The specimen is preserved in the Madras Herbarium, Coimbatore.

Literature.

Qusumbing Eduardo (1926).
Phillip. Agri.: 15, pp. 3-11.
Garden's Bull. 3, pp. 274-279.
Garden's Bull. 4, pp. 78-86.

AGRICULTURAL RESEARCH INSTITUTE, K. CHERIAN JACOB,
COIMBATORE. L.Ag., F.L.S.
April 20, 1940.

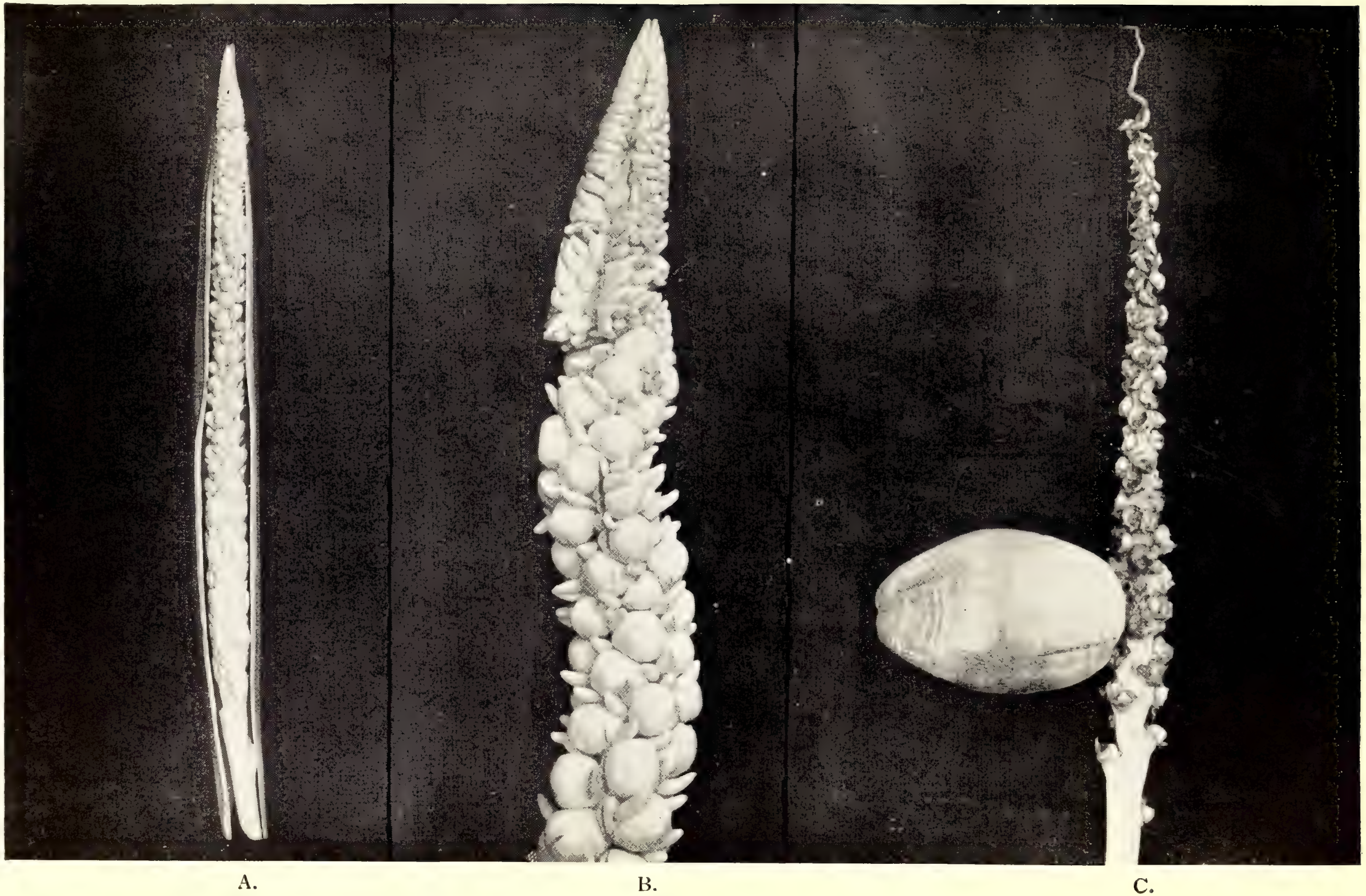
XXIII.—A NEW VARIETY OF COCONUT PALM (*COCOS NUCIFERA* L. VAR. *SPICATA* K. C. JACOB).

(*With a plate*).

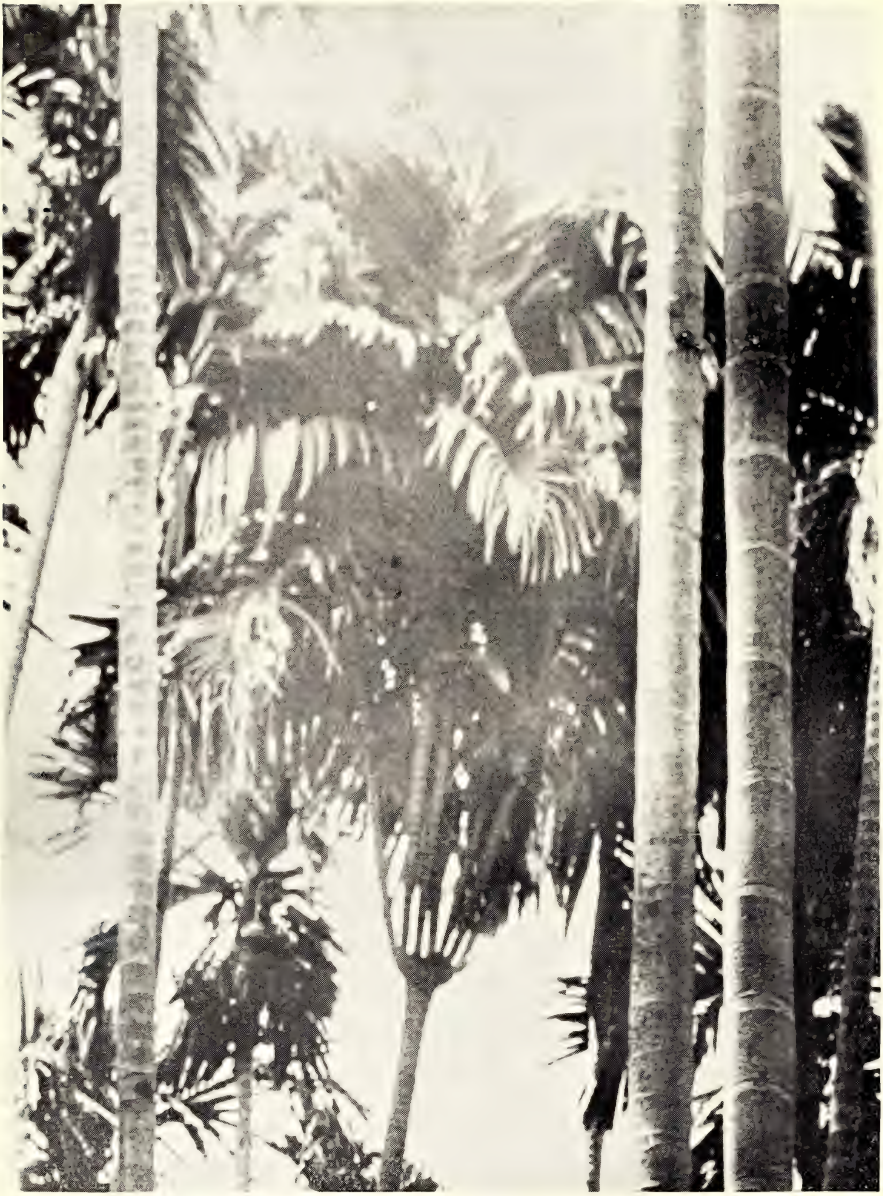
A note on a peculiar coconut tree is published in the *Madras Agricultural Journal,* Vol. v, page 86. Its peculiarity lies in the inflorescence which, unlike that of the ordinary coconut palm, is unbranched. There is a note on the 'suppression of spikelets in coconut spadices' in the *Garden's Bulletin,* Vol. iv, page 81. Here the author mentions that the palms which produce the monstrous inflorescences have the habit of producing such monstrosities many times during the year. Mention is also made by the same author of a side branch which is occasionally found in these monstrous inflorescences.

The present writer had occasion to study palms which produce these monstrous inflorescences in more detail in a garden in Coimbatore. In this garden there are half a dozen such palms. The occurrence of a side branch is noticed in some inflorescences. From the history of these palms, it is noted that the production of this abnormal spike-like inflorescence is not a freak, but a heritable character. Several similar instances are also noted in other parts of this Province. Hence this new type of coconut palm with the spike-like inflorescence is separated as a new variety, *Cocos nucifera* L. var. *spicata* K. C. Jacob. In the light of this knowledge, the description of the spadix of the species, *Cocos nucifera* L. may be altered to 'usually panicled, sometimes spiked'.

On account of the spike-like nature of the panicle, there is not enough room for the development of a large number of nuts. Nevertheless, this variety produces innumerable female flowers (potential nuts), which character may be utilized with advantage by coconut palm breeders.



Inflorescence of *Cocos nucifera* Linn. var. *spicata* K. C. Jacob.
A. Young inflorescence. B. as A, magnified. C. Spike with a coconut.



Branched Areca Palm (*Areca catechu* L.), Kallar Gardens.

Literature.

Cooke, T., *Bombay Flora,* Vol. II, p. 812.
Madras Agri. Journal, Vol. V, p. 86.
Garden's Bulletin, Vol. IV, p. 81.
Ann. Jard. Bot. Buitenzorg, Vol. XXXII (1923), p. 24.

AGRICULTURAL RESEARCH INSTITUTE, K. CHERIAN JACOB,
COIMBATORE. L.Ag., F.L.S.
April 20, 1940.

XXIV.—STEM FASCIATION IN THE ARECA PALM (*ARECA CATECHU* L.)

(*With a plate*).

Stem fasciation in the Areca palm is a rare phenomenon. An interesting instance of it was noticed in an Areca palm garden at Kallar, Coimbatore District. The palm is about 55 years old and 65 feet in height. At this height it has produced 9 branches, all in one plane. All the branches, except one which is dead, though much thinner than the parent stem, are growing well, producing flowers and nuts regularly. These branches are about 15 years old and 8 feet in height. There is no evidence of insect attack or other disease likely to have caused this fasciation.

The hill tribes of the Lower Nilgiris, the Irulars, hold this plant in veneration, and make offerings for its blessings.

AGRICULTURAL RESEARCH INSTITUTE, K. CHERIAN JACOB,
COIMBATORE. L.Ag., F.L.S.
February 20, 1936.

XXV.—PRELIMINARY NOTES ON A RECENT BOTANICAL TOUR TO AMRABAD FOREST RESERVE, H. E. H. THE NIZAM'S DOMINIONS, HYDERABAD (DN.).

(*With* 1 *plate*).

Having studied in some detail (1), the flora of the Mulug Taluqa of the Warangal District which is country typical of the Telangana side, it was proposed to study the vegetation of Amrabad Taluqa in the Mahboobnagar District, situated at a distance of 116 miles south of Hyderabad city. It is 1,913 ft. high and is surrounded by eight hill ranges which extend up to the river Krishna. The only Botanical work which helps one to get some knowledge of the vegetation of Amrabad is the one by Partridge (2), a forest officer, who does not seem to have spent much time in the study of the vegetation on this side, as is evident from his description of the localities of the plants he has recorded. In his book he mentions Amrabad about five times, and leaves out many important and prominent forest trees of this region. To take only one example, he does not mention the occurrence in great abundance of *Bauhinia Vahlii* W. & A. in Amrabad. Salim Ali (³) in his more recent *Ornithological Survey of Hyderabad* gives a brief but informative and interesting note about Mananur and Farahabad in which he mentions a few important and dominant forest trees and shrubs in these places, and he evidently does so because of the intimate relation of bird-life with vegetation.

The author with his colleagues in the Botany Department of the Osmania University undertook a botanical tour to Amrabad Forest Reserve in February, 1940. Making Mananur the head-quarters, Farahabad and Amrabad proper were visited. The latter is not described in detail here as the stay there was short and the collections do not include any thing new to Mananur or Farahabad.

MANANUR.

Mananur is situated on the Amrabad Plateau at an altitude of 2,059 ft., and a distance of 111 miles from Hyderabad city. The soil for the most part is laterite and the country is mostly hilly. Nearing Mananur one sees luxuriant tree vegetation, otherwise about hundred miles of the journey is frightfully monotonous. Considering the vastness of the land the cultivated portion is surprisingly small. Along the roadsides *Cassia auriculata* Linn., *Anona squamosa* Linn., and *Wrightia tomentosa* Roem. & Sch. amongst shrubs, and *Melia Azadirachta* Linn., *Acacia* spp. amongst trees are repeatedly noticed. Toddy palms occur and their appearance is a clear sign of nearing a habitation. While climbing the first hill range on which Mananur is situated we came across wild trees of *Moringa pterigosperma* Gaertn. (Plate I, photo 1).

Mananur forest was studied in some detail by paying visits to Omamaheshwaram, 4½ miles from the traveller's bungalow. One has to cover this distance on foot. After walking a few furlongs from this bungalow one enters the forest to climb a hill. Here and there are thick Bamboo clumps (*Dendrocalamus strictus* Nees, Plate I, photo 2). The hillsides are strewn with large stones, walking on which is very tiresome. They are cut across by narrow *nallahs* (streams). Near the last *nallah* before we began climbing up the rugged steps to reach the plateau we came across wild mango trees of enormous size. *Terminalia* spp. (Maddi chettu etc.), *Hardwickia binata* Roxb. (Ippa, Anjan), *Pterocarpus Marsupium* Roxb. (Bijasal), *Bassia latifolia* Roxb. (Mhowa) are some of the dominant trees in this region. *Tectona grandis* Linn. (Teak) is not so plentiful as in Farahabad, and is of a stunted growth. A few furlongs brought us to the plateau with its scattered and scrubby vegetation. Thorny shrubs of the Rubiaceae, Euphorbiaceae and other families are abundant. After crossing the plateau we came to the edge of the hill with a steep valley to our right, facing Pedda-Omamaheshwaram which was our destination. We carefully went down hill and arrived at the dripping rocks. To us the interest lay in the vegetation of these rocks and not in the

Sayeedud-Din—Botanical Tour to Amrabad Forest Reserve.

For explanation see end of article.

famous temple which is carved out of the rock in this region. In the valley lofty trees with the dominant *Bauhinia Vahlii* W. & A. could be seen. The dripping rocks were covered with liverworts, mosses and ferns which will be included in the detailed list of collections at the end.

FARAHABAD.

Twelve miles south of Mananur lies Farahabad on another plateau rising above Amrabād Plateau at an altitude of 2,800 ft. The forest consists of mixed deciduous species as in the Mananur forest, but considerably thicker, and containing a good deal of more bamboo and teak. The thickest bamboo forest is met with near the Chinchuar Hut (Chinchuars otherwise known as Bhils are a primitive tribe), 5 miles from the Farahabad traveller's bungalow. Coming out of this thicket one has to walk in about a foot thick layer of the fallen leaves of *Bauhinia Vahlii* W. & A. *Tectona grandis* Linn. is more plentiful than in the Mananur forest. *Buchanania latifolia* Roxb. and *Dalbergia latifolia* Roxb. which were very scarce at Mananur are widespread in this region. *Mundulea suberosa* Benth. in its pinkish bloom was a striking little tree near the roadsides.

The collections which have been so far identified include :—

I. Flowering Plants.

(*a*) Trees :

Boswellia serrata Roxb.
Feronia elephantum Correa.
Aegle Marmelos Correa.
Cassia Fistula Linn.
Butea frondosa Roxb.
Bombax malabaricum DC.
Tectona grandis Linn.
Murraya Koenigii Linn.
Pongamia glabra Vent.
Hardwickia binata Roxb.
Dalbergia latifolia Roxb.
Strychnos potatorum Linn.
Stephegyne parvifolia Korth.
Mangifera indica Linn.
Diospyros Melanoxylon Roxb.
Diospyros tomentosa Roxb.
Terminalia tomentosa W. & A.
Alangium Lamarckii Thwaites.
Atalantia monophylla Correa.
Buchanania latifolia Roxb.
Chloroxylon Swietenia DC
Bassia latifolia Roxb.
Anogeissus latifolia Wall.
Ailanthus excelsa Roxb.
Phyllanthus Emblica Linn.

(*b*) Shrubs :

Zizyphus Oenoplia Mill.
Grewia hirsuta Vahl.
Cassia auriculata Linn.
Dodonaea viscosa Linn.
Randia dumetorum Lamk.
Andrographis paniculata Linn.
Phyllanthus reticulatus Poir.
Gymnosporia montana Roxb.
Zizyphus trinervia Roxb.
Grewia pilosa Lamk.
Capparis horrida Linn.
Helicteres Isora Linn.
Pavetta indica Linn.
Vitex Negundo Linn.

(*c*) Herbs :

Cardiospermum Halicacabum Linn.
Blepharis molluginifolia Pers.
Sansiviera zeylanica Willd.
Plumbago zeylanica Linn.
Striga spp.

(*d*) Lofty Climbers :

Bauhinia Vahlii W. & A.
Hiptage Madablota Gaertn.
Argyreia speciosa Sweet.

(*e*) Parasites :

Loranthus longiflorus Desr.
on *Buchanania latifolia*,
Bassia latifolia and others.
Viscum articulatum Burm.
on *Diospyros tomentosa.*

Loranthus elasticus Desr.
on *Bassia latifolia.*

II. Bryophytes.

(*a*) *Anthoceros* sp.

(*b*) Moss?

III. Pteridophytes.

(*a*) *Selaginella* sp.

(*b*) Ferns :

1. *Adiantum caudatum* Linn.
2. *Cheilanthus mysorensis* Wall.
3. *Actiniopteris dichotoma* Forsk.
4. *Nephrolepis* sp.

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EXPLANATION OF PLATE I.

Photo 1.—Panoramic view of a hill range on the way to Mananur. The arrow showing the site of the wild trees of *Moringa pterigosperma* Gaertn.

Photo 2.—A bamboo clump. Note the scattered stones.

M. SYEEDUD-DIN,
Prof. of Botany.

OSMANIA UNIVERSITY,
HYDERABAD, DECCAN.
January, 1940.

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FORT, BOMBAY

THE

GAME-BIRDS OF INDIA, BURMA & CEYLON.

BY

E. C. STUART BAKER, C.I.E., O.B.E., F.L.S., F.Z.S., M.B.O.U., H.F.A.O.U.

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